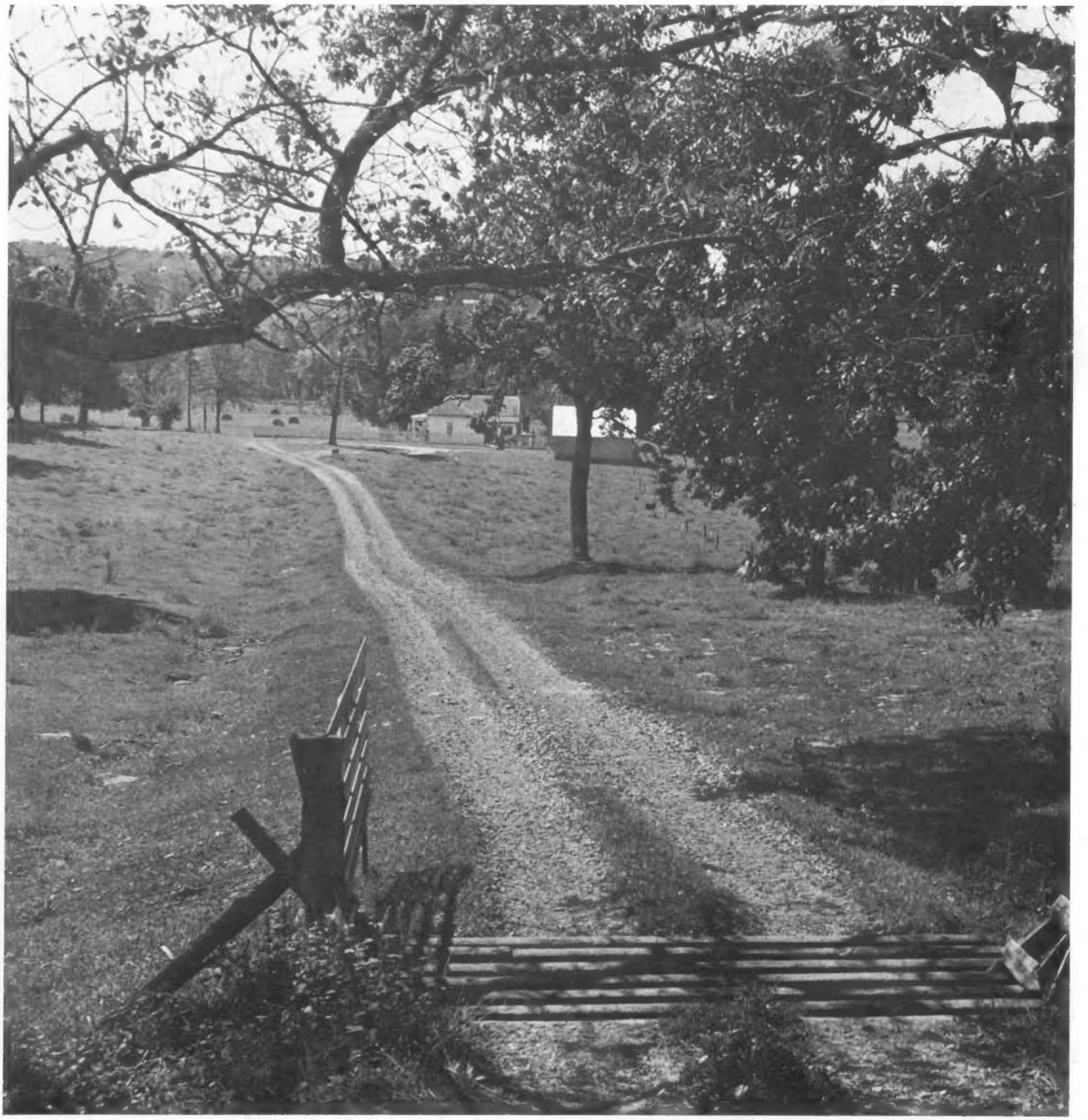
United States Department of Agriculture

Soil Conservation Service

In cooperation with Missouri Agricultural Experiment Station

Soil Survey of Hickory County, Missouri



How To Use This Soil Survey

General Soil Map

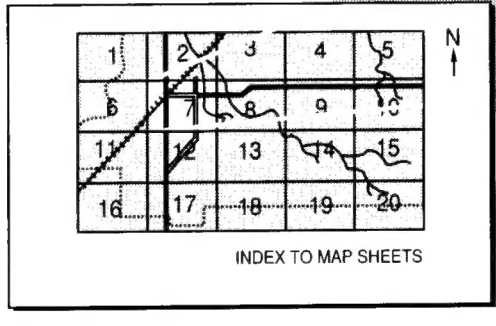
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

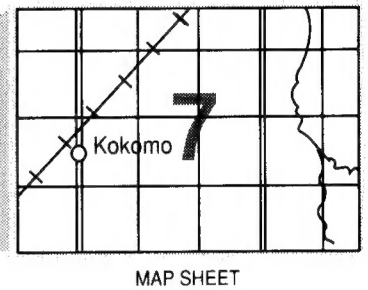
Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.

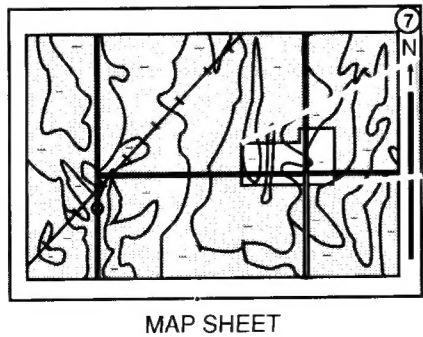


INDEX TO MAP SHEETS



MAP SHEET

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



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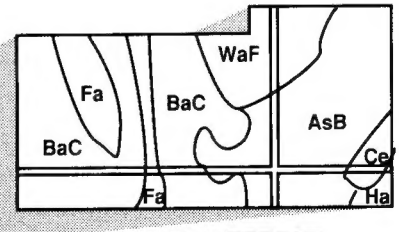

AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1987. Soil names and descriptions were approved in 1988. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1987. This survey was made cooperatively by the Soil Conservation Service and the Missouri Agricultural Experiment Station. The Missouri Department of Natural Resources provided a soil scientist to assist with the fieldwork, and additional financial assistance was provided by the Hickory County Board of Commissioners. The survey is part of the technical assistance furnished to the Hickory County Soil and Water Conservation District.

Soil maps in this survey may be copied without permission. Enlargement of these maps, however, could cause misunderstanding of the detail of mapping. If enlarged, maps do not show the small areas of contrasting soils that could have been shown at a larger scale.

All programs and services of the Soil Conservation Service are offered on a nondiscriminatory basis without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: Wooded pasture in an area of the Bardley-Gasconade association. Gasconade soils are in the foreground.

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Issued July 1991

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Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Hickory County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

This soil survey is designed for many different users. Farmers, foresters, and agronomists can use it to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the survey to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are shallow over bedrock. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Soil Conservation Service or the Cooperative Extension Service.

Russell C. Mills
State Conservationist
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Soil Survey of Hickory County, Missouri

By George T. Simmons, Soil Conservation Service, and David Goggins, Missouri Department of Natural Resources

Fieldwork by George T. Simmons, Soil Conservation Service; David Goggins, Department of Natural Resources; and John Francka and Dudley Kaiser, Hickory County Soil and Water Conservation District

United States Department of Agriculture, Soil Conservation Service, in cooperation with the Missouri Agricultural Experiment Station

HICKORY COUNTY is in the central part of Missouri (fig. 1). It has an area of 263,654 acres, or about 411.96 square miles, which includes about 6,800 acres of water. Hermitage, the county seat, is in the central part of the county. In 1986, the population of the county was about 7,000.

The county was organized on February 14, 1845, from parts of Benton and Polk Counties. It was named in honor of General Andrew Jackson, who was familiarly called "Old Hickory." The county seat, Hermitage, was named after Jackson's residence.

Most of the county is in the Ozark Highland and Ozark Border Land Resource Area of the East and Central Farming and Forest Region of the United States *(10)*.

Figure 1.—Location of Hickory County in Missouri.

General Nature of the County

This section gives general information concerning the county. It describes climate, the history of farming, and physiography and geology.

Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

Hickory County is hot in summer, especially at low elevations, and moderately cool in winter. Rainfall is fairly heavy and is well distributed throughout the year. Snow falls nearly every winter, but the snow cover usually lasts only a few days.

Table 1 gives data on temperature and precipitation for the county as recorded in the period 1961 to 1984 at

Pomme de Terre Dam, near Hermitage. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 32 degrees F and the average daily minimum temperature is 21 degrees. The lowest temperature on record, which occurred at Pomme de Terre Dam on February 1, 1979, is -21 degrees. In summer, the average temperature is 77 degrees and the average daily maximum temperature is 88 degrees. The highest recorded temperature, which occurred on July 31, 1980, is 109 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The average annual precipitation is 39.15 inches. Of this, about 24 inches, or about 60 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 19 inches. The heaviest 1-day rainfall during the period of record was 5.9 inches at Pomme de Terre Dam on October 16, 1965. Thunderstorms occur on about 57 days each year. Tornadoes and severe thunderstorms occur occasionally but are local in extent and of short duration. They cause damage in scattered small areas. Hailstorms sometimes occur in scattered small areas during the warmer part of the year.

The average seasonal snowfall is 11 inches. The greatest snow depth at any one time during the period of record was 12 inches. On the average, 8 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the south-southeast. Average windspeed is highest, 13 miles per hour, in spring.

History of Farming

The first settlers came to the area now known as Hickory County in 1834 and 1835. They settled along the major streams and their tributaries. Several water mills were constructed along the Pomme de Terre and Little Niangua Rivers and Starks Creek to grind meal and saw lumber for the settlers. Most of the settlers cleared some land near their farmsteads. On individual farms a horse, a milk cow, and two or three oxen were fenced in on this cleared land.

Settlement was from the north along an old military road that ran from Palmyra, Missouri, through Hickory County, and to Fort Smith, Arkansas. Some descendants of the early settlers claim that their ancestors were on their way to Texas and for some reason, such as sickness or a bad winter, decided to settle in this area after trading oxen for land.

The settlers were a mixture of farmers, gamblers, horse traders, and land speculators. The gamblers and land speculators tried to run some of the farmers off of the best land. Their actions caused a minor uprising called the "Slicker War," which lasted from 1848 to 1850 *(5)*. One faction would catch members of the other faction alone and whip them with a hickory switch, locally called a slicker.

About 25 percent of the acreage in the county was native grass prairie when the first settlers arrived. Much of the remaining acreage was open timberland *(6)*. The settlers cleared much of the timber for crop production. In areas of Eldon, Gepp, and other soils, they picked rocks from fields in an effort to make the soils more tillable (fig. 2). Most of these fields were abandoned and are now seeded to pasture grasses or have been allowed to revert to woodland. Many of the farmsteads were located in areas of shallow soils, such as the Gasconade soil in Gasconade-Rock outcrop complex, 3 to 9 percent slopes. The rocks in these areas were used for early farmstead fences (fig. 3).

Farm and wood products currently are the main local sources of income. The principal crops are corn, soybeans, grain sorghum, and winter wheat. The main kinds of livestock are beef cattle, hogs, dairy cattle, and poultry.

Physiography and Geology

Hickory County is in two physiographic provinces that are closely associated with geologic material. Most of the county is in the Ozark Plateau region. The Western Plains region, which is the easternmost part of the Great Plains of the United States, fingers into the west side of the county in several places.

The Ozark Plateau region includes the Salem Plateau on the eastern side of the county and the Springfield Plateau. The Salem Plateau is separated from the Springfield Plateau by the Eureka Springs

Figure 2.—An area where rocks have been removed from the surface of Eldon cherty silt loam, 3 to 9 percent slopes.

Escarpment, which generally is directly west of the Pomme de Terre River. The eastern edge of this escarpment has many sinkholes. Most of the drainage on the Springfield Plateau is away from the Pomme de Terre River to the northwest, except for a few sinkholes that drain into the river. The undulating to very hilly Salem Plateau, which has a greater degree of dissection and stream entrenchment than the Springfield Plateau, is underlain by Ordovician rocks. The Springfield Plateau, which is mainly undulating, is underlain by Mississippian rocks. The areas of the Western Plains in the county are nearly level and undulating. They are underlain by Pennsylvanian rocks. The bedrock is at various depths. It consists of sedimentary rocks, mostly dolomite, limestone, sandstone, and shale.

The youngest rocks in the county underlie the Hartwell-Eldon-Barden association, which is described under the heading "General Soil Map Units." These rocks are of Pennsylvanian age. They are part of the Cherokee Group, a coarse grained to fine grained sandstone, the base of which has some conglomerate that is typical of the Warner Formation *(3)*. The formations are comparatively thin and are exposed in less than 2 percent of the county.

Cambrian rocks, the oldest formation in the county, are not exposed. Rocks of the Ordovician age overlie the Cambrian rocks. The Roubidoux and Jefferson City Formations are the dominant formations exposed in the county. They are very similar in lithology. They consist dominantly of cherty dolomite. The Roubidoux Formation includes lenses and beds of sandstone. It is an important source of water throughout the western part of the county.

Between the Pennsylvanian and Ordovician rocks are the Mississippian rocks, which are dominantly cherty

Figure 3.—A flagstone fence built with stones cleared from an area of Gasconade-Rock outcrop complex, 3 to 9 percent slopes.

limestone. The content of chert ranges from minor amounts in the Burlington and Warsaw Formations to abundant amounts in the Pierson and Compton Formations. The Burlington Formation crops out extensively in many areas in the western part of the county.

Unconsolidated surficial deposits include residuum, loess, colluvium, and alluvium. Residuum and colluvium are dominant throughout the county. Some upland areas have a thin mantle of loess. The alluvium is on flood plains.

Water for domestic and farm uses is provided by streams, lakes, and ponds. Ground water from springs sustains the flow of perennial streams. Deep wells provide water to Elkton, Hermitage, Nemo, Skyline, Weaubleau, and Wheatland. Adequate water of good quality for home and farm uses can be obtained from the Roubidoux Formation and from deeper aquifers. Wells that tap the Roubidoux Formation can produce 10 to 30 gallons per minute in the eastern part of the county and 15 to 85 gallons per minute in the western part. Larger yields can be obtained by drilling to deeper aquifers, such as Gasconade dolomite, the Gunter member of the Gasconade Formation, and Eminence or Potosi dolomite *(4)*.

How This Survey Was Made

This survey was made to provide information about the soils in the county. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of

slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the county occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the county and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the county and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the county, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the county, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to

other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soil on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

The general soil map at the back of this publication shows the soil associations in this survey area. Each association has a distinctive pattern of soils, relief, and drainage. Each is a unique natural landscape. Typically, an association consists of one or more major soils and some minor soils. It is named for the major soils. The soils making up one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

The descriptions, names, and delineations of the soils identified on the general soil map of this county do not fully agree with those of the soils identified on the maps of adjacent counties published at a different date. Differences are the result of additional soil data, variations in the intensity of mapping, and correlation decisions that reflect local conditions. In some areas combining small acreages of similar soils that respond to use and management in much the same way is more practical than mapping these soils separately.

Soil Descriptions

1. Bardley-Gasconade Association

Shallow and moderately deep, gently sloping to very steep, well drained and somewhat excessively drained soils; on uplands

This association consists of soils on narrow upland ridges highly dissected by V-shaped drainageways and narrow flood plains. Slopes range from 3 to 50 percent.

This association makes up about 40 percent of the county. It is about 54 percent Bardley soils, 26 percent Gasconade soils, and 20 percent minor soils (fig. 4).

The Bardley soils are on the tops and sides of ridges. They are moderately deep, gently sloping to very steep, and well drained. Typically, the surface layer is dark brown very cherty silt loam about 5 inches thick. The subsurface layer is dark yellowish brown very cherty silt loam about 9 inches thick. The subsoil is about 13 inches thick. The upper part is red cherty clay. The lower part is strong brown clay. Dolomite or limestone bedrock is at a depth of about 27 inches.

The Gasconade soils are on side slopes and ridgetops and in saddles. They are shallow, gently sloping to very steep, and somewhat excessively drained. Typically, the surface layer is very dark brown flaggy silty clay loam about 5 inches thick. The subsoil is very dark brown very flaggy silty clay loam about 8 inches thick. Limestone or dolomite bedrock is at a depth of about 13 inches.

Minor in this association are the Claiborne, Gepp, Racket, and Lebanon soils. The deep, well drained Claiborne soils are on foot slopes. They are silty throughout. The deep, well drained Gepp soils are on narrow ridgetops. The deep, moderately well drained Lebanon soils are on the tops of the broader ridges. They have a fragipan. The deep, nearly level Racket soils are on narrow flood plains.

Most areas of this association support second-growth timber that is harvested and sold as firewood, logs, fenceposts, and other wood products. Some areas are used for grasses and legumes that are fed to beef and dairy cattle.

Most of the soils in this association are suitable for pasture and trees. Pasture plants and trees grow fairly well on the Bardley soils. The Gasconade soils support cedar trees or warm-season grasses. Droughtiness, the shallowness to bedrock, rock outcrop, and the slope are the main management concerns in the pastured areas. Seedling mortality and the windthrow hazard are the main management concerns in the wooded areas.

The major soils are suited to sanitary facilities and building site development. The main management concerns are the slope, seepage, and the depth to bedrock.

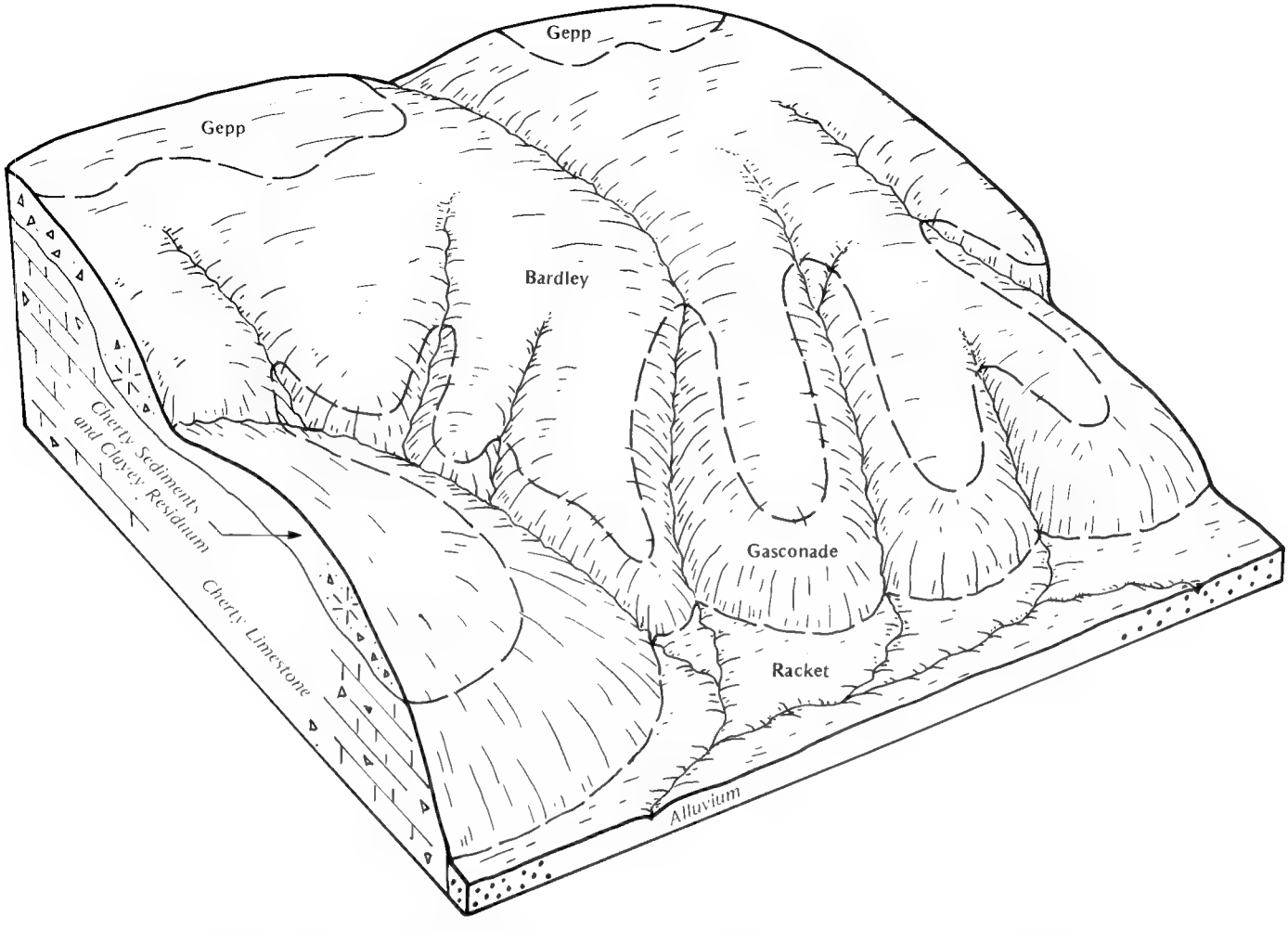

Figure 4.—Typical pattern of soils and parent material in the Bardley-Gasconade association.

2. Hartwell-Eldon-Barden Association

Deep, nearly level to strongly sloping, somewhat poorly drained to well drained soils; on uplands

This association consists of soils on the tops and sides of broad upland ridges. Slopes range from 0 to 14 percent.

This association makes up about 14 percent of the county. It is about 31 percent Hartwell soils, 25 percent Eldon soils, 21 percent Barden soils, and 23 percent minor soils (fig. 5).

The Hartwell soils are nearly level and very gently sloping and are somewhat poorly drained. Typically, the surface layer is very dark grayish brown silt loam about 6 inches thick. The subsurface layer is grayish brown silt loam about 4 inches thick. The subsoil is about 24 inches thick. The upper part is very dark grayish brown, mottled clay. The lower part is grayish brown, mottled silty clay. The substratum to a depth of 60 inches is gray, mottled silty clay loam.

The Eldon soils are gently sloping to strongly sloping and are well drained. Typically, the surface layer is very dark grayish brown cherty silt loam about 6 inches thick. The subsurface layer is dark brown cherty silt loam about 4 inches thick. The upper part of the subsoil is dark yellowish brown and yellowish red very cherty and extremely cherty silty clay loam. The lower part to a depth of 60 inches or more is red cherty silty clay and cherty clay.

The Barden soils are gently sloping and moderately

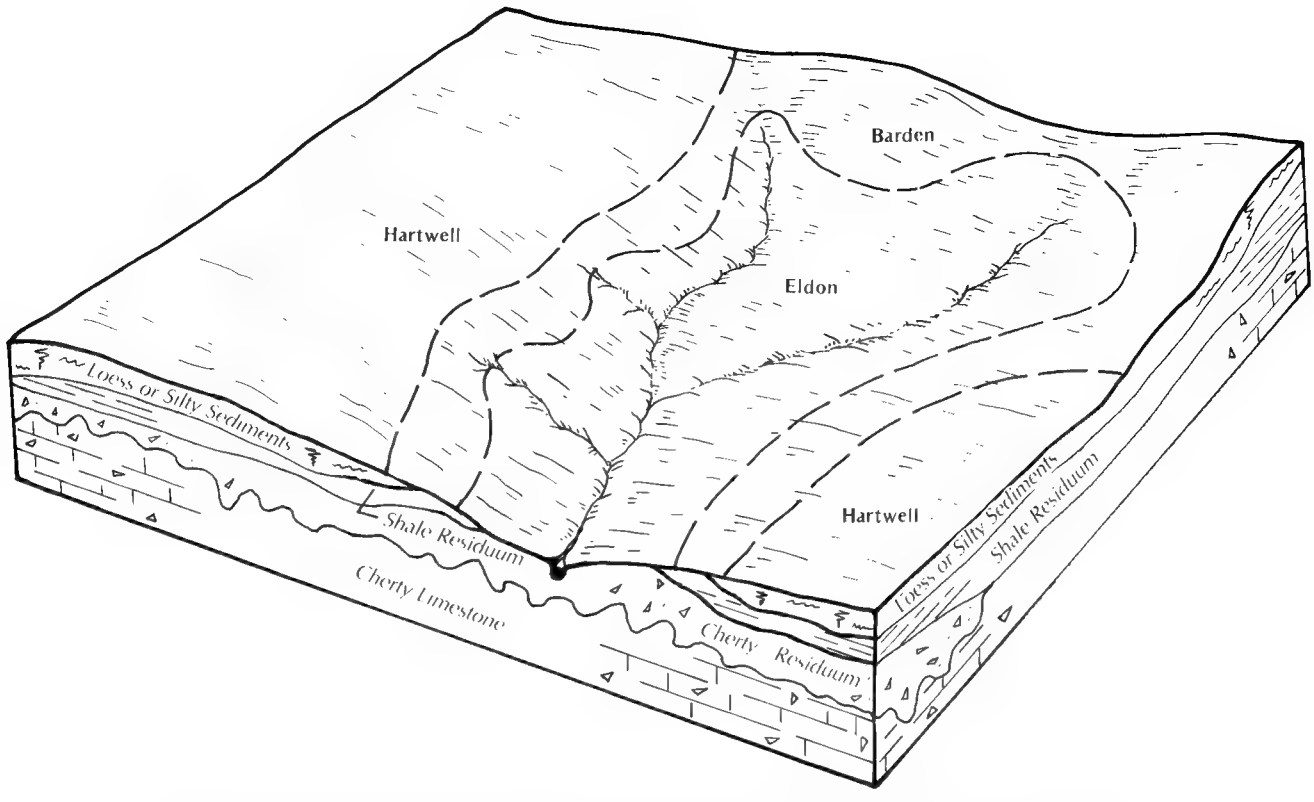

Figure 5.—Typical pattern of soils and parent material in the Hartwell-Eldon-Barden association.

well drained. Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsoil is about 32 inches thick. The upper part is very dark grayish brown silty clay loam. The next part is dark brown, mottled silty clay. The lower part is light brownish gray, mottled silty clay loam. The substratum to a depth of 60 inches is yellowish brown, mottled silty clay loam.

Minor in this association are the Barco, Creldon, Sampsel, and Verdigris soils. The moderately deep, well drained Barco soils are on mounds and on ridgetops and side slopes. Creldon soils are on narrow ridgetops. They have a fragipan. The poorly drained Sampsel soils are on foot slopes and at the head of drainageways. The moderately well drained Verdigris soils are on flood plains. They have dark colors that extend deep into the profile.

The farms in areas of this association are large and are worked with heavy machinery. Most of the row crops in the county are grown on this association. Some areas are used for grasses and legumes for pasture or hay. Wheat, soybeans, grain sorghum, and corn generally are sold as cash crops. The forage and some of the grain are fed to dairy cattle, beef cattle, and other livestock.

The Hartwell and Barden soils are well suited to small grain, row crops, and grasses and legumes. Under highly specialized management, row crops can be grown year after year. The suitability is good for irrigated crops, especially high-value crops, but an inadequate supply of water limits the acreage that can be irrigated. The Eldon soils are well suited to grasses for pasture and in places can be hayed.

Wheat, soybeans, sorghum, and most of the common grasses and legumes in the county grow well on the soils in this association. The main management concern is controlling erosion, especially in cropped areas that have long, gradual slopes or shorter slopes of more than 2 percent. Measures that improve surface drainage are needed in the nearly level areas.

The major soils are suited to sanitary facilities and building site development. The main management concerns are wetness, a high shrink-swell potential, and a shallow or moderate depth to clayey material.

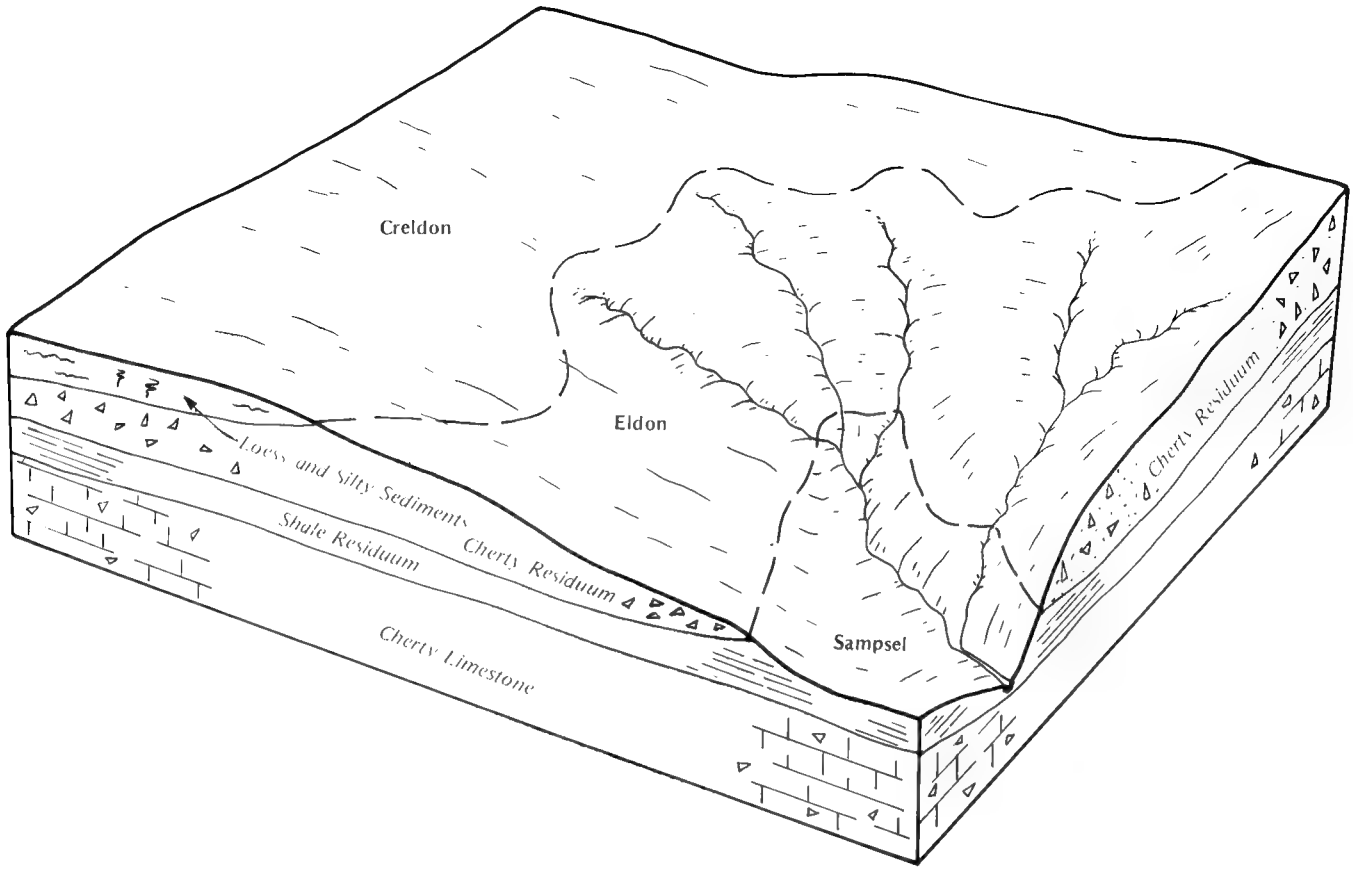

Figure 6.—Typical pattern of soils and parent material in the Eldon-Creldon association.

3. Eldon-Creldon Association

Deep, gently sloping to strongly sloping, moderately well drained and well drained soils; on uplands

This association consists of soils on broad upland ridges dissected by drainageways and narrow flood plains. Slopes range from 2 to 14 percent.

This association makes up about 16 percent of the county. It is about 34 percent Eldon and similar soils, 33 percent Creldon and similar soils, and 33 percent minor soils (fig. 6).

The Eldon soils are on convex ridgetops and side slopes. They are gently sloping to strongly sloping and are well drained. Typically, the surface layer is very dark grayish brown cherty silt loam about 6 inches thick. The subsurface layer is dark brown cherty silt loam about 4 inches thick. The subsoil is about 60 inches thick. The upper part is dark yellowish brown and yellowish red very cherty and extremely cherty silty clay loam. The lower part is red cherty silty clay and cherty clay.

The Creldon soils are on ridgetops and the upper side slopes. They are gently sloping and moderately well drained. Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsoil is about 51 inches thick. The upper part is dark brown, mottled silty clay loam. The next part is a fragipan of dark grayish brown, mottled, brittle silty clay loam about 11 inches thick. The lower part is dark yellowish brown, mottled cherty silty clay and very cherty clay.

Minor in this association are the Barden, Bardley, McGirk, Sampsel, and Racket soils. Barden soils do not have a fragipan and have fewer chert fragments than the Eldon soils. They are on side slopes and the tops of ridges. The moderately deep, well drained, gently sloping to very steep Bardley soils are on narrow ridgetops and side slopes. The poorly drained, gently

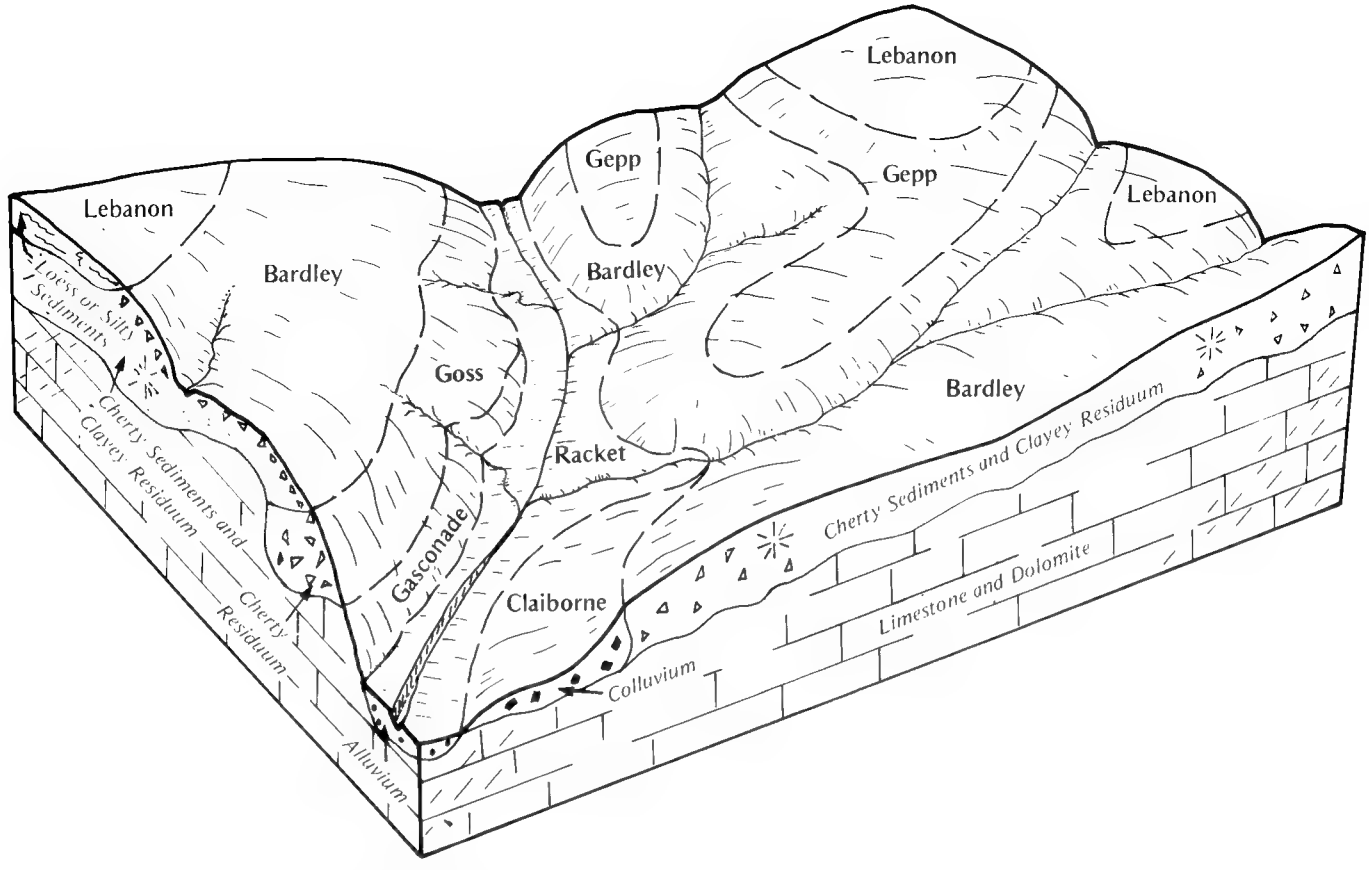

Figure 7.—Typical pattern of soils and parent material in the Bardley-Lebanon-Gepp association.

sloping McGirk soils are on foot slopes. The poorly drained Sampsel soils are on the concave lower side slopes. The well drained, nearly level Racket soils are on narrow flood plains. They have dark colors that extend deep into the profile.

Nearly all areas of this association are used for grasses and legumes. Some small areas are wooded. A few areas are used for row crops grown for silage. The forage and grain are fed to beef and dairy cattle.

Most of the soils in this association are well suited to grasses and legumes. All of the common forage and grain crops in the county grow well on these soils. Planting and harvesting on the Eldon soils are difficult because of the chert on the surface. Because of the fragipan, the Creldon soils have a limited root zone and a perched high water table in most winter and spring months. The main management concerns are droughtiness and erosion, especially in row cropped areas that have slopes of more than 2 percent.

The major soils are suited to sanitary facilities and building site development. The main management concerns are wetness and the shrink-swell potential of the clayey subsoil.

4. Bardley-Lebanon-Gepp Association

Moderately deep and deep, gently sloping to very steep, well drained and moderately well drained soils; on uplands

This association consists of soils on narrow upland ridges highly dissected by V-shaped drainageways and narrow flood plains. Slopes range from 2 to 50 percent.

This association makes up about 16 percent of the county. It is about 52 percent Bardley soils, 16 percent Lebanon soils, 15 percent Gepp soils, and 17 percent minor soils (fig. 7).

The Bardley soils are on the tops and sides of ridges. They are moderately deep, gently sloping to very steep, and well drained. Typically, the surface layer is dark brown very cherty silt loam about 5 inches thick. The

subsurface layer is dark yellowish brown very cherty silt loam about 9 inches thick. The subsoil is about 13 inches thick. The upper part is red cherty clay. The lower part is strong brown clay. Dolomite or limestone bedrock is at a depth of about 27 inches.

The Lebanon soils are on the tops of broad ridges. They are deep, gently sloping and moderately sloping, and moderately well drained. Typically, the surface layer is yellowish brown silt loam about 6 inches thick. The subsoil extends to a depth of 60 inches or more. In sequence downward, it is yellowish brown and strong brown silty clay loam; yellowish brown, mottled silty clay; a fragipan of light brownish gray, mottled, brittle silty clay loam and brown cherty silty clay loam; and red cherty silty clay.

The Gepp soils are on ridgetops and side slopes. They are deep, gently sloping and moderately sloping, and well drained. Typically, the surface layer is dark grayish brown very cherty silt loam about 5 inches thick. The subsurface layer is pale brown very cherty silt loam about 8 inches thick. The subsoil is mottled. The upper part is yellowish red cherty clay. The lower part to a depth of 70 inches or more is red clay.

Minor in this association are the Claiborne, Gasconade, Goss, and Racket soils. Claiborne soils are silty throughout. They are on foot slopes. The shallow, somewhat excessively drained Gasconade soils are on the tops and sides of ridges. Goss soils have more chert throughout than the major soils. They are on the sides of ridges. The nearly level Racket soils are on narrow flood plains. They have dark colors that extend deep into the profile.

Nearly all areas of this association are used for grasses and legumes or for trees. The acreage of pasture is about the same as that of woodland. A very small acreage is used for small grain or row crops. The forage and grain are fed to beef and dairy cattle. Most mature trees are harvested and sold as logs, firewood, posts, and other wood products.

Most of the soils in this association are well suited to grasses and legumes. Most of the common grasses and legumes in the county grow well on these soils. The main management concerns are droughtiness and overgrazing.

The suitability of this association for trees is fair or good. Trees grow well on the lower slopes, on some ridgetops, on the strongly sloping to steep soils on north- and east-facing slopes, and on the minor soils on flood plains. The windthrow hazard on the Bardley and Lebanon soils and seedling mortality on the Bardley soils are the main management concerns.

The major soils are suited to sanitary facilities and building site development. The main management concerns are the depth to bedrock, moderate permeability, the shrink-swell potential, seepage, and the slope.

5. Goss-Gasconade Association

Deep and shallow, gently sloping to very steep, well drained and somewhat excessively drained soils; on uplands

This association consists of soils on narrow upland ridges and side slopes. Slopes range from 3 to 50 percent.

This association makes up about 10 percent of the county. It is about 54 percent Goss and similar soils, 25 percent Gasconade soils, and 21 percent minor soils (fig. 8).

The Goss soils are on side slopes. They are deep, well drained, and moderately steep to very steep. Typically, the surface layer is very dark grayish brown very cherty silt loam about 2 inches thick. The subsurface layer is yellowish brown very cherty silt loam about 10 inches thick. The upper part of the subsoil is yellowish brown very cherty silty clay loam. The next part is red very cherty clay. The lower part to a depth of 60 inches or more is red clay.

The Gasconade soils are on side slopes and ridgetops and in saddles. They are shallow, somewhat excessively drained, and gently sloping to very steep. Typically, the surface layer is very dark brown flaggy silty clay loam about 5 inches thick. The subsoil is very dark brown very flaggy silty clay loam about 8 inches thick. Limestone bedrock is at a depth of about 13 inches.

Minor in this association are the Lebanon, McGirk, and Moniteau soils. The moderately well drained Lebanon soils are on broad ridges. They have a fragipan. McGirk and Moniteau soils are poorly drained. McGirk soils are on foot slopes, and Moniteau soils are on high flood plains.

Most areas of this association support second-growth timber that is harvested and sold as firewood, logs, cedar posts, and other wood products. Some areas are used for grasses and legumes that are fed to beef and dairy cattle.

Most of the soils in this association are suitable for pasture and trees. A low or very low available water capacity, droughtiness, the shallowness to bedrock, rock outcrop, and the slope are the main limitations in the pastured areas. Seedling mortality and the windthrow hazard are the main management concerns in the areas used for trees.

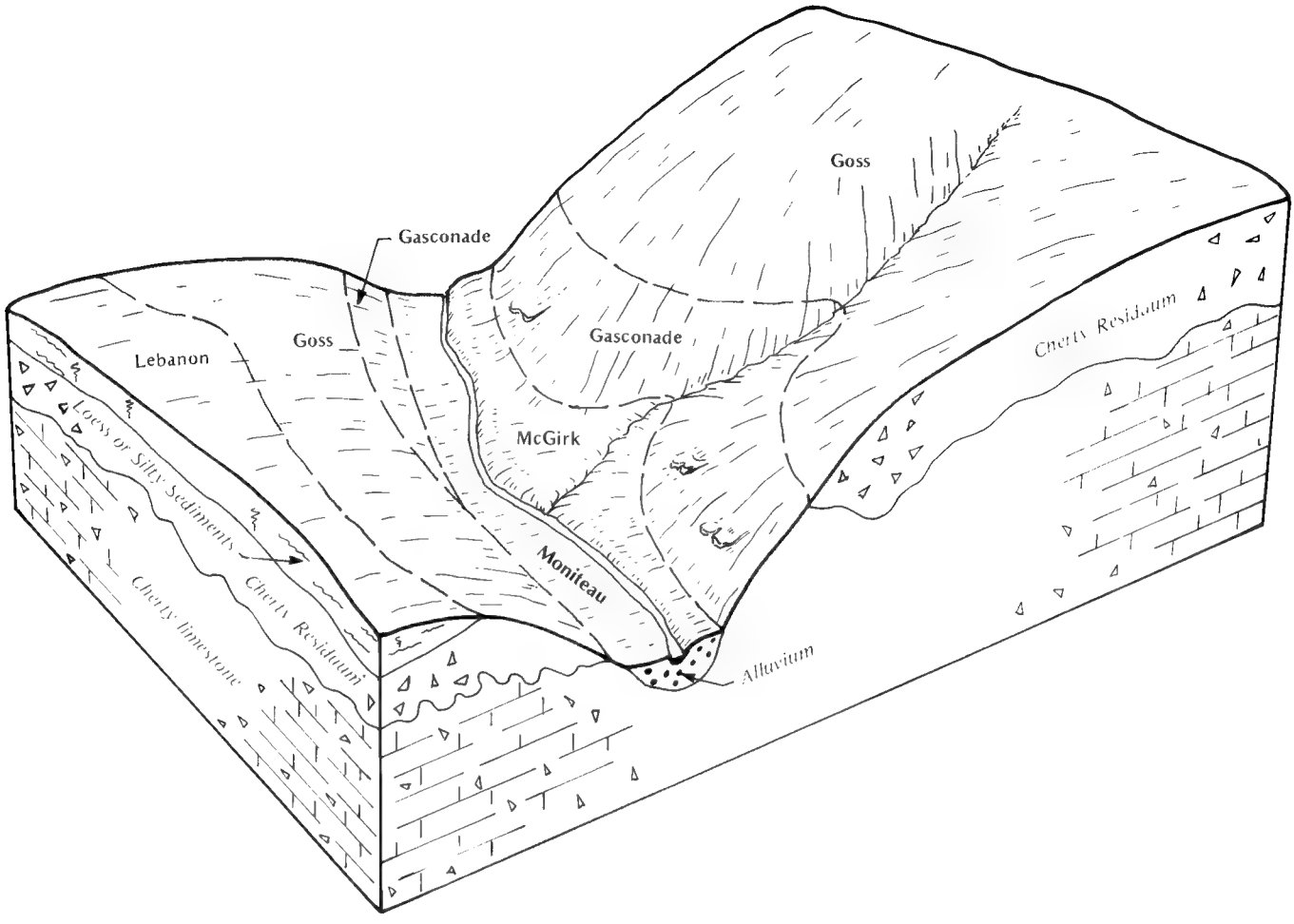

Figure 8.—Typical pattern of soils and parent material in the Goss-Gasconade association.

The major soils are suited to sanitary facilities and building site development. The main management concerns are the slope, seepage, and the depth to bedrock.

6. Racket-Claiborne-Ashton Association

Deep, nearly level and moderately sloping, well drained soils; on flood plains, foot slopes, and side slopes

This association consists of soils on flood plains along small streams and on foot slopes and side slopes along stream valleys. Slopes range from 0 to 9 percent.

This association makes up about 4 percent of the county. It is 36 percent Racket soils, 30 percent Claiborne soils, 19 percent Ashton soils, and 15 percent minor soils.

The Racket soils are on flood plains. They are nearly level. Typically, the surface layer is very dark grayish brown silt loam about 6 inches thick. The subsurface layer is about 42 inches thick. The upper part is very dark grayish brown silt loam, and the lower part is dark brown silt loam and loam. The substratum to a depth of 60 inches or more is brown loam.

The Ashton soils are on high flood plains. They are nearly level. Typically, the surface layer is dark brown silt loam about 7 inches thick. The subsoil to a depth of 60 inches or more is dark brown silty clay loam.

The Claiborne soils are on foot slopes and upland side slopes along stream valleys. They are moderately sloping. Typically, the surface layer is dark yellowish brown silt loam about 6 inches thick. The upper part of the subsoil is strong brown silty clay loam. The next part is dark brown silt loam. The lower part to a depth of 60 inches or more is yellowish red and red silty clay loam.

Minor in this association are the poorly drained

McGirk, Moniteau, and Sampsel soils. The silty and clayey McGirk soils are on foot slopes. Moniteau soils are on high flood plains. The dark Sampsel soils are on foot slopes.

Most of the soils in this association are used for pasture or hay. A few areas are used for row crops or small grain. The association is suited to row crops, small grain, grasses, legumes, and trees. The hazard of erosion on foot slopes and occasional flooding on the flood plains are the main management concerns.

The Claiborne soils are suitable for onsite waste disposal and building site development. The slope and moderate permeability are the main management concerns on sites for sanitary facilities. The Ashton and Racket soils generally are unsuitable for onsite waste disposal and building site development because of flooding.

Detailed Soil Map Units

The map units on the detailed soil maps at the back of this survey represent the soils in the survey area. The map unit descriptions in this section, along with the soil maps, can be used to determine the suitability and potential of a soil for specific uses. They also can be used to plan the management needed for those uses. More information on each map unit, or soil, is given under "Use and Management of the Soils."

Each map unit on the detailed soil maps represents an area on the landscape and consists of one or more soils for which the unit is named.

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer or of the substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer or of the substratum. They also can differ in slope, stoniness, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Hartwell silt loam, 1 to 3 percent slopes, eroded, is a phase of the Hartwell series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils, or one or more soils and a miscellaneous area, in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Gasconade-Rock outcrop complex, 3 to 9 percent slopes, is an example.

Most map units include small scattered areas of soils other than those for which the map unit is named. Some of these included soils have properties that differ substantially from those of the major soil or soils. Such differences could significantly affect use and management of the soils in the map unit. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits and dumps is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown are identified by a special symbol on the soil maps.

The descriptions, names, and delineations of soils identified on the detailed soil maps of this county do not fully agree with those of the soils identified on the maps of adjacent counties published at a different date. Differences are the result of additional soil data, variations in the intensity of mapping, and correlation decisions that reflect local conditions. In some areas combining small acreages of similar soils that respond to use and management in much the same way is more practical than mapping these soils separately.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of Tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil Descriptions

10—Pits and dumps. This map unit consists of narrow mine pits and irregularly shaped dumps. Most of the pits are dry during mining operations but then are partly filled with water after mining ceases. Individual areas range from about 5 to more than 40 acres in size.

Pits are open excavations from which soil material and the underlying rock have been removed. They have bottoms and sides of rock or other material that

Figure 9.—An area of Pits and dumps. The soil material and rocks excavated from this area are used as fill and construction material on other sites.

supports few or no plants. Dumps are piles of mixed soil material, rock, parts of old machinery, and other refuse (fig. 9).

Steep slopes, large stones, and the exposed rock restrict the use of this unit. Almost no vegetation can be grown. The smaller pits, however, can be reclaimed with a minimum investment. After reclamation, they can produce an adequate plant cover. As the size of the mined area and the intensity of mining activities increase, the difficulty of reclamation and the investment required to reclaim a given area also increase. Most of the pits can be developed into a source of water for wildlife, irrigation, or livestock. The pits typically are open at one end and do not contain

enough water to be economically important.

Some areas are suited to grasses and legumes for pasture if they are leveled and shaped before they are seeded. Management that maintains an adequate plant cover helps to prevent excessive soil loss and improves the available water capacity by reducing the runoff rate. Overstocking and overgrazing deplete the protective plant cover and cause deterioration of the plant community. A planned grazing system that includes proper stocking rates and a uniform distribution of grazing help to keep the pasture in good condition.

This unit generally is unsuitable for building site development and sanitary facilities. Some of the pits have potential as sanitary landfills, but onsite investigation is needed to determine the suitability for specific uses.

This unit is not assigned a land capability classification or a woodland ordination symbol.

11—Udorthents, clayey. These soils are in excavated areas from which 3 to 10 feet of soil material has been removed. The soil material was borrowed and used mainly in the construction of highways and levees. Individual areas are rectangular bands that parallel the highways and levees. They are about 10 to more than 50 acres in size.

Typically, the surface layer is dark yellowish brown, very firm gravelly silty clay about 4 inches thick. The substratum is yellowish brown, mottled very gravelly clay about 18 inches thick. Hard dolomite bedrock is at a depth of about 22 inches.

Included with these soils in mapping are small areas of exposed bedrock.

Permeability is slow or very slow, and the available water capacity is low. Fertility also is low, and the organic matter content is low or very low.

Most areas have a scant to fair cover of grasses, legumes, and weeds. They are used mainly for recreation or grazing or are idle. In some areas the suitability for grasses and legumes and for recreational development is fair or good. The suitability for trees is poor because the available water capacity is low and the clayey surface layer is detrimental to seeds and seedlings planted in these soils.

These soils generally are unsuitable for building site development and onsite waste disposal because of a high shrink-swell potential, the slow or very slow permeability, and the depth to bedrock. Careful onsite investigation prior to construction is essential if the soils are used as building sites.

These soils are not assigned a land capability classification or a woodland ordination symbol.

13B—Sampsel silty clay loam, 2 to 5 percent slopes. This deep, gently sloping, poorly drained soil is at the head of drainageways in the uplands and on foot slopes. Individual areas are irregular in shape and range from about 5 to more than 200 acres in size.

Typically, the surface layer is very dark gray, friable silty clay loam about 10 inches thick. The subsoil to a depth of 70 inches or more is silty clay loam. The upper part is very dark gray and friable, the next part is dark gray and firm, and the lower part is gray, mottled, and firm. Some areas are eroded. In places the surface layer is silt loam.

Included with this soil in mapping are areas of McGirk soils. These soils do not have a dark surface layer. They are in landscape positions similar to those of the Sampsel soil. They make up 5 to 10 percent of the unit.

Permeability is slow in the Sampsel soil. Surface runoff is medium. The available water capacity is moderate. Organic matter content also is moderate, and natural fertility is medium. The surface layer is friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after hard rains. A perched water table is within a depth of 1.5 feet during most winter and spring months. The shrink-swell potential is high in the subsoil.

This soil is suited to corn, soybeans, and small grain. Erosion is a hazard if cultivated crops are grown. The wetness caused by upslope runoff is a limitation. A system of conservation tillage that leaves a protective cover of crop residue on the surface, diversion terraces, and grassed waterways help to control erosion and reduce the wetness. In a few areas where slopes are suitable, terraces and contour farming can help to control erosion. Returning crop residue to the soil and regularly adding other organic material improve fertility and tilth and help to prevent crusting.

Most areas are used for pasture or hay. This soil is moderately well suited to most of the legumes and cool-season grasses commonly grown in the county. The suitability for warm-season grasses is fair. The species that are tolerant of wetness grow best. Erosion during seedbed preparation is the main problem. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

This soil is suited to building site development. The high shrink-swell potential and the wetness are limitations. Properly designing dwellings and constructing footings and foundations with adequately reinforced concrete can help to prevent the structural damage caused by shrinking and swelling. Installing tile drains around the footings helps to prevent the

structural damage caused by excessive wetness. If the site can be leveled, sewage disposal can be handled by sewage lagoons. Because of the slow permeability and the wetness, the soil is unsuitable as a site for septic tank absorption fields.

Low strength, the shrink-swell potential, frost action, and the wetness are limitations on sites for local roads and streets. Crushed rock or other suitable material can help to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling, frost action, and wetness.

The land capability classification is IIe. No woodland ordination symbol is assigned.

15—Ashton silt loam. This deep, nearly level, well drained soil is on high flood plains along small streams. It is occasionally flooded. Individual areas are irregular in shape and range from about 5 to more than 40 acres in size.

Typically, the surface layer is dark brown, very friable silt loam about 7 inches thick. The subsoil to a depth of 60 inches or more is dark brown, friable silty clay loam. In some areas the soil has gravel on the surface.

Included with this soil in mapping are small areas of the moderately sloping Claiborne soils, Racket soils, and the moderately well drained Verdigris soils. Claiborne soils are redder throughout the subsoil than the Ashton soil. They are on the upper parts of the landscape. Racket and Verdigris soils are dark to a greater depth than the Ashton soil. They are adjacent to stream channels. Also included are some areas that are only rarely flooded. Included soils make up about 10 percent of the unit.

Permeability is moderate in the Ashton soil. Surface runoff is slow. The available water capacity is high. Organic matter content is moderate, and natural fertility is medium. The surface layer is very friable and can be easily tilled throughout a fairly wide range in moisture content.

This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, the occasional flooding in the spring is a hazard. Diversion terraces help to control the runoff from the adjacent upslope soils. Applying a system of conservation tillage that leaves crop residue on the surface and returning large amounts of crop residue to the soil improve tilth.

Most areas are used for pasture or hay. This soil is well suited to most of the cool-season grasses commonly grown in the county and is moderately well suited to most legumes and warm-season grasses. Flood-tolerant species grow best. The occasional flooding is the main problem. It should be considered when a grazing system is designed.

A few small areas are wooded. This soil is suited to trees. No major hazards or limitations affect planting or harvesting.

This soil generally is unsuited to building site development and onsite waste disposal because of the occasional flooding.

The land capability classification is IIw. The woodland ordination symbol is 4A.

20B—Creldon silt loam, 2 to 5 percent slopes. This deep, gently sloping, moderately well drained soil is on the tops and upper sides of ridges in the uplands. Individual areas are irregular in shape and range from about 10 to more than 150 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 9 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is dark brown, mottled, friable and firm silty clay loam. The next part is a fragipan of dark grayish brown, mottled, very firm, brittle silty clay loam. The lower part is dark yellowish brown, mottled, very firm cherty silty clay and very cherty clay.

Included with this soil in mapping are areas of the somewhat poorly drained Plato soils, Barden soils, and the well drained Eldon soils. Plato soils have less chert in the subsoil than the Creldon soil and are grayer throughout. They are in saddles and near the head of drainageways. Barden soils do not have chert or a fragipan in the subsoil. They are in the less sloping areas where the ridgetops are broader. Eldon soils have more chert in the surface layer and in the upper part of the subsoil than the Creldon soil. They are on the lower side slopes. Included soils make up about 5 to 15 percent of the unit.

Permeability is moderately slow above the fragipan in the Creldon soil and very slow in the fragipan. Surface runoff is medium. The available water capacity is moderate. Organic matter content is moderately low, and natural fertility is medium. The surface layer is very friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after heavy rains. Root penetration is restricted by the fragipan at a depth of about 30 inches. A perched water table is at a depth of 1.5 to 3.0 feet during most winter and spring months. The shrink-swell potential is high.

Most areas are used for cultivated crops, hay, or pasture. This soil is suited to corn, soybeans, small

grain, and grain sorghum. If cultivated crops are grown, erosion is a hazard. Because of the moderate rooting depth, droughtiness is a limitation. Contour farming and no-till farming or other kinds of conservation tillage that leave a protective amount of crop residue on the surface help to control erosion, maintain the content of organic matter, improve tilth, increase the rate of water infiltration, and help to maintain fertility. Terraces and grassed waterways can help to control erosion if the cuts do not expose the fragipan.

This soil is well suited to most warm-season grasses and some warm-season legumes and is moderately well suited to most cool-season grasses and legumes. The rooting depth is only moderate, and droughtiness is a problem during much of the year. Erosion is a major hazard if the soil is tilled during seedbed preparation. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

This soil is suited to building site development. The high shrink-swell potential and the wetness are limitations on sites for dwellings without basements. Constructing footings and foundations with adequately reinforced concrete can help to prevent the structural damage caused by shrinking and swelling. Installing tile drains around the footings helps to prevent the structural damage caused by excessive wetness. Seepage and the wetness are limitations on sites for sewage lagoons. Sealing the bottom and berms of the lagoon with slowly permeable material helps to prevent seepage and the contamination of ground water. Constructing the bottom of the lagoon above the fragipan also minimizes seepage. Because of the very slow permeability and the wetness, the soil generally is unsuitable as a site for septic tank absorption fields.

Low strength, the shrink-swell potential, frost action, and the wetness are limitations on sites for local roads and streets. Crushed rock or other suitable material can help to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling, frost action, and wetness.

The land capability classification is IIe. No woodland ordination symbol is assigned.

23F—Goss very cherty silt loam, 14 to 45 percent slopes. This deep, moderately steep to very steep, well drained soil is on dissected side slopes in the uplands. Individual areas are irregular in shape and range from 5 to more than 300 acres in size.

Typically, the surface layer is very dark grayish brown, very friable very cherty silt loam about 2 inches thick. The subsurface layer is yellowish brown, very friable very cherty silt loam about 10 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is yellowish brown, friable very cherty silty clay loam; the next part is red, very firm very cherty clay; and the lower part is red, very firm clay. In some areas the subsoil is not so clayey.

Included with this soil in mapping are stony areas and areas where the depth to bedrock is 40 to 60 inches. Also included are areas of Bardley, Claiborne, and Gepp soils, which are less cherty than the Goss soil; Eldon soils, which are darker than the Goss soil; and the somewhat excessively drained Gasconade soils. Bardley and Gasconade soils are in landscape positions similar to those of the Goss soil or are in the steeper areas. Claiborne soils are on foot slopes. Gepp and Eldon soils are in the less sloping areas. Included soils make up about 10 to 15 percent of the unit.

Permeability is moderate in the Goss soil. Surface runoff is rapid. The available water capacity is low. Organic matter content is moderately low, and natural fertility is low.

Many areas are used for timber. A large acreage supports native hardwoods. This soil is suited to trees. The erosion hazard, the equipment limitation, and seedling mortality are management concerns. Planting nursery stock that is larger than is typical or planting container-grown stock increases the seedling survival rate. In many places the seedlings cannot be planted by machine because of the slope and the chert in the surface layer. Logging roads and skid trails should be built on the contour.

Some areas are used for pasture. This soil is suited to crownvetch, lespedeza, and tall fescue and to all of the warm-season grasses commonly grown in the county. Droughtiness, water erosion, and the chert fragments in the surface layer are the main management concerns. The soil generally is unsuitable as hayland because of the slope. Tillage should be avoided.

This soil generally is unsuitable for onsite waste disposal and building site development because of the slope.

The land capability classification is VIIe. The woodland ordination symbol is 3R.

30—Verdigris silt loam. This deep, nearly level, moderately well drained soil is on flood plains near streams. It is occasionally flooded. Individual areas are

long and narrow or irregular in shape and range from about 5 to more than 100 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 9 inches thick. The subsurface layer is about 36 inches of very dark grayish brown, very friable and friable silt loam and silty clay loam. Below this to a depth of 72 inches or more is a buried layer of very dark gray, mottled, friable silty clay loam. In places the soil has a cherty substratum. Some areas are frequently flooded.

Included with this soil in mapping are the poorly drained Moniteau soils and the well drained Racket soils. Moniteau soils are lighter colored than the Verdigris soil. They are on high flood plains near the uplands. Racket soils are in landscape positions similar to those of the Verdigris soil or are on the lower parts of the landscape. Also included are areas of stream channels. Included areas make up about 10 to 15 percent of the unit.

Permeability is moderate in the Verdigris soil. Surface runoff is slow. The available water capacity is high. Organic matter content is moderate, and natural fertility is high. The surface layer is very friable and can be easily tilled throughout a fairly wide range in moisture content. The shrink-swell potential is moderate.

This soil is well suited to corn, grain sorghum, and small grain. If cultivated crops are grown, planting and harvesting should be scheduled for periods when flooding is unlikely. Winter cover crops and crop residue management help to maintain tilth and increase the rate of water infiltration.

Most areas are used for pasture. This soil is well suited to most of the cool-season grasses commonly grown in the county and is moderately well suited to most legumes and warm-season grasses. The occasional flooding is the main problem. It should be considered when a grazing system is designed. The species selected for planting should be those that can tolerate flooding of short duration.

This soil is well suited to trees. Tree seeds, cuttings, and seedlings grow well if competing vegetation is controlled or removed by mechanical or chemical means. No other major hazards or limitations affect planting or harvesting.

This soil generally is unsuitable for building site development and onsite waste disposal because of the flooding. It is a good source of topsoil and cover material for sanitary landfills. It tends to slough and compress when used as material for dikes and levees.

The land capability classification is IIw. The woodland ordination symbol is 4A.

32—Racket silt loam, loamy substratum. This deep, nearly level, well drained soil is on flood plains along stream channels. It is occasionally flooded. Individual areas are long and narrow and range from about 5 to more than 80 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 6 inches thick. The subsurface layer is about 42 inches thick. It is very dark grayish brown, very friable silt loam in the upper part and dark brown, very friable silt loam and loam in the lower part. The substratum to a depth of 60 inches or more is brown, very friable loam. In some areas the surface layer is loam or silty clay loam.

Included with this soil in mapping are areas of the moderately well drained Verdigris soils. These soils are in landscape positions similar to those of the Racket soil or are higher on the landscape. Also included are stream channels and gravel beds. Included areas make up about 10 to 15 percent of the unit.

Permeability is moderate in the Racket soil. Surface runoff is slow. The available water capacity is moderate. Organic matter content also is moderate, and natural fertility is medium. A seasonal high water table is at a depth of 3.5 to 6.0 feet during extended wet periods. The surface layer is very friable and can be easily tilled throughout a wide range in moisture content.

Most areas are used for pasture or hay. This soil is well suited to most of the legumes and cool-season grasses commonly grown in the county and is moderately well suited to most warm-season grasses. The occasional flooding is the main problem. It should be considered when a grazing system is designed. Flood-tolerant species grow best.

Some areas are cultivated. If cultivated crops are grown on this soil, measures that conserve moisture and prevent the excessive soil loss caused by scouring during periods of flooding are needed.

This soil is suited to trees. Seedlings survive and grow well if competing plants are removed or controlled. Plant competition can be controlled by proper site preparation or by spraying or cutting. No other major hazards or limitations affect planting or harvesting.

This soil generally is unsuitable for building site development and onsite waste disposal because of the occasional flooding.

The land capability classification is IIw. The woodland ordination symbol is 5A.

50B—McGirk silt loam, 2 to 5 percent slopes. This deep, gently sloping, poorly drained soil is on concave side slopes at the head of drainageways in the uplands and on concave foot slopes. Individual areas are

irregular in shape and range from about 5 to more than 80 acres in size.

Typically, the surface layer is dark grayish brown, very friable silt loam about 5 inches thick. The subsoil is about 41 inches thick. It is grayish brown, friable silty clay loam and grayish brown, mottled, firm silty clay in the upper part; dark gray, mottled, very firm silty clay in the next part; and mottled light brownish gray, yellowish brown, and dark yellowish brown, firm silty clay loam in the lower part. The substratum to a depth of 60 inches or more is mottled light gray, yellowish brown, and dark yellowish brown, firm silty clay loam. In some areas the soil is eroded. In other areas it is not so wet.

Included with this soil in mapping are soils that have as much as 10 percent coarse fragments in the surface layer and subsoil. These soils are in landscape positions similar to those of the McGirk soil. Also included are areas of the well drained Ashton and Claiborne soils and areas of Sampsel soils. Ashton soils are on high flood plains. Claiborne soils are on foot slopes and side slopes on the upper parts of the landscape. Sampsel soils are dark to a greater depth than the McGirk soil. They are in positions on the landscape similar to those of the McGirk soil. Included soils make up about 10 to 15 percent of the unit.

Permeability is slow in the McGirk soil. Surface runoff is medium. The available water capacity is moderate. Organic matter content is moderately low, and natural fertility is medium. The surface layer is very friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after heavy rains. A perched water table is at a depth of 0.5 foot to 2.0 feet during most winter and spring months. The shrink-swell potential is high.

Most areas are used for pasture or cultivated crops. This soil is best suited to shallow-rooted, water-tolerant grasses and legumes for pasture or hay. It is not suited to deep-rooted plants. Erosion is the main problem. The pasture should be tilled on the contour. Proper stocking rates and pasture rotations that include rest periods help to keep the pasture in good condition.

This soil is suited to corn, soybeans, and small grain. If cultivated crops are grown, water erosion is a hazard and the wetness caused by runoff from the adjacent soils upslope is a limitation. Applying a system of conservation tillage that leaves a protective cover of crop residue on the surface helps to control water erosion. The wetness can be reduced by diversion terraces. Returning crop residue to the soil or regularly adding other organic material improves tilth and helps to prevent crusting.

A few small areas support native hardwoods. This soil is suited to trees. The windthrow hazard and seedling mortality are the main management concerns. The stands should be thinned less intensively and more frequently than the stands in areas where the windthrow hazard is slight. Planting nursery stock that is larger than is typical or is container grown increases the seedling survival rate. The trees should be harvested during periods when the surface is firm enough to support heavy equipment.

This soil is suitable for building site development. The high shrink-swell potential and the wetness are limitations. Properly designing dwellings and constructing footings and foundations with adequately reinforced concrete can help to prevent the structural damage caused by shrinking and swelling. Installing tile drains around the footings helps to prevent the structural damage caused by excessive wetness. The soil is unsuitable as a site for septic tank absorption fields because of the wetness. It is suitable as a site for sewage lagoons. The slope is a moderate limitation, but it can be overcome by grading the lagoon site.

Low strength, the shrink-swell potential, frost action, and the wetness are limitations on sites for local roads and streets. Crushed rock or other suitable material can help to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling, frost action, and wetness.

The land capability classification is IIe. The woodland ordination symbol is 3W.

51C—Claiborne silt loam, 5 to 9 percent slopes. This deep, moderately sloping, well drained soil is at the edge of stream valleys. It is in the steeper areas at the base of foot slopes. Individual areas are irregular in shape and range from about 5 to more than 100 acres in size.

Typically, the surface layer is dark yellowish brown, very friable silt loam about 6 inches thick. The subsoil extends to a depth of 60 inches or more. It is dark brown, very friable silt loam in the upper part and yellowish red and red, friable silty clay loam in the lower part. Some areas are eroded and gullied. In places the lower part of the subsoil has gray mottles.

Included with this soil in mapping are small areas of the poorly drained McGirk and Sampsel soils. These soils are in concave areas. They make up 5 to 15 percent of the unit.

Permeability is moderate in the Claiborne soil. Surface runoff is medium. The available water capacity

is high. Organic matter content is moderately low, and natural fertility is low. The surface layer is very friable and can be easily tilled throughout a fairly wide range in moisture content. Eroded areas crust or puddle after heavy rains. The shrink-swell potential is moderate.

This soil is suited to small grain. If cultivated crops are grown, erosion is a hazard. Gullying, which has occurred in several areas, restricts cultivation. A system of conservation tillage that leaves a protective cover of crop residue on the surface, winter cover crops, and grassed waterways help to prevent excessive soil loss. In a few areas slopes are long enough and smooth enough for terraces and contour farming. Returning crop residue to the soil or regularly adding other organic material improves fertility and tilth and increases the rate of water infiltration.

Most areas are used for hay and pasture. This soil is well suited to most of the legumes and warm- and cool-season grasses commonly grown in the county. No serious problems affect pasture or hayland. Erosion is a hazard in newly seeded areas. Timely seedbed preparation helps to ensure a good ground cover. Nurse crops of small grain can provide a protective cover late in the fall.

A few small areas support native hardwoods. This soil is suited to trees. Tree seeds, cuttings, and seedlings survive and grow well if competing plants are controlled or removed. Plant competition can be controlled by proper site preparation, which can include spraying or cutting. No other major hazards or limitations affect planting or harvesting.

This soil is suitable for building site development and onsite waste disposal. The shrink-swell potential is a limitation on sites for dwellings. Constructing foundations and footings with adequately reinforced concrete helps to prevent the structural damage caused by shrinking and swelling. The moderate permeability is a limitation on sites for septic tank absorption fields. Enlarging the absorption field helps to overcome this limitation. Sewage lagoons can function adequately if the site is leveled and the berms and bottom of the lagoon are sealed with slowly permeable material. These measures help to prevent seepage and the contamination of ground water.

Low strength, the shrink-swell potential, and frost action are limitations on sites for local roads and streets. Crushed rock or other suitable material can help to prevent the damage caused by shrinking and swelling and by low strength. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIIe. The woodland ordination symbol is 4A.

54—Moniteau silt loam. This deep, nearly level, poorly drained soil is on high flood plains. It is occasionally flooded. Individual areas are long and narrow or irregular in shape and range from about 5 to more than 200 acres in size.

Typically, the surface layer is dark grayish brown, very friable silt loam about 7 inches thick. The subsurface layer is mixed light brownish gray and light gray, very friable silt loam about 7 inches thick. The subsoil is about 56 inches thick. It is grayish brown, mottled, very friable silt loam in the upper part; light brownish gray, mottled, friable silty clay loam in the next part; and mottled light gray and dark brown, friable silty clay loam in the lower part. Some areas are frequently flooded.

Included with this soil in mapping are small areas of the well drained Racket and moderately well drained Verdigris soils on bottom land. These soils are nearer the stream channel than the Moniteau soil. They make up about 10 percent of the unit.

Permeability is moderately slow in the Moniteau soil. Surface runoff is slow. The available water capacity is high. The content of organic matter and natural fertility are low. The surface layer is very friable and can be easily tilled, but runoff is so slow that in places tillage is delayed by wetness in most years. A perched water table is within a depth of 1 foot during most winter and spring months. The shrink-swell potential is moderate.

Most areas are used for cultivated crops or pasture. This soil is suited to soybeans, grain sorghum, and small grain. Corn can be grown, but yields generally are reduced by wetness in the spring and insufficient soil moisture in the summer. A system of conservation tillage that leaves a protective cover of crop residue on the surface and winter cover crops improve fertility, minimize crusting, and increase the rate of water infiltration.

This soil is best suited to water-tolerant, shallow-rooted forage species. It is poorly suited to hay. The wetness and the flooding are the main management concerns. The flooding should be considered when a grazing system is designed. Maintaining stands of desirable species is difficult in depressional areas. A surface drainage system is beneficial, especially if the deeper rooted species are grown.

This soil is suited to trees. The species selected for planting should be those that can tolerate wetness. The equipment limitation, seedling mortality, and windthrow

are the main management concerns. Ridging the soil and then planting on the ridges can increase the seedling survival rate. The stands should be thinned less intensively and more frequently than the stands in areas where the windthrow hazard is slight. The trees should be planted and harvested when the soil is firm enough to support heavy equipment.

This soil generally is unsuitable for building site development and onsite waste disposal because of the occasional flooding.

The land capability classification is IIIw. The woodland ordination symbol is 4W.

55B—Barco sandy loam, 2 to 5 percent slopes. This moderately deep, gently sloping, well drained soil is on convex ridgetops, mounds, and the upper side slopes in the uplands. Individual areas are irregular in shape and range from about 5 to more than 40 acres in size.

Typically, the surface soil is very dark grayish brown, very friable sandy loam about 12 inches thick. The subsoil is dark brown, dark yellowish brown, yellowish brown, and yellowish red, very friable and friable clay loam about 15 inches thick. Soft sandstone bedrock is at a depth of about 27 inches. In some areas the surface layer is loam. In other areas the soil has scattered sandstone rocks on the surface.

Included with this soil in mapping are areas of the moderately well drained Barden and Creldon soils and the cherty Eldon soils. Barden soils have more clay in the subsoil than the Barco soil. They are in the lower landscape positions. Creldon and Eldon soils are deep and have cherty layers. They are in landscape positions similar to those of the Barco soil or are in the lower areas. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Barco soil. Surface runoff is medium. The available water capacity is low. Organic matter content is moderately low, and natural fertility is medium. The surface layer is very friable and can be easily tilled throughout a fairly wide range in moisture content. Roots are restricted in most places by the soft sandstone bedrock at a depth of 20 to 40 inches. The shrink-swell potential is moderate.

This soil is suited to small grain. It is suited to corn, soybeans, and grain sorghum, but yields are reduced in most years by insufficient soil moisture during the summer. If cultivated crops are grown, erosion is a hazard. Terraces and grassed waterways can help to control erosion if the cuts do not expose the bedrock. No-till farming or other kinds of conservation tillage that leave a protective cover of crop residue on the surface can help to control erosion, maintain the content of organic matter, improve tilth, increase the rate of water infiltration, and help to maintain fertility.

Most areas are used as tall fescue pasture. This soil is well suited to most warm-season grasses and to birdsfoot trefoil and is moderately suited to most cool-season grasses and legumes (fig. 10). The moderate rooting depth and droughtiness are limitations. Water erosion is a major hazard if the soil is tilled during seedbed preparation. Timely tillage and a quickly established ground cover help to prevent excessive erosion.

This soil is suitable for building site development. The shrink-swell potential is a limitation. Constructing foundations and footings with adequately reinforced concrete helps to prevent the structural damage caused by shrinking and swelling. The underlying soft sandstone can be a limitation on sites for septic tank absorption fields. A properly constructed mound system, in which the amount of absorption material above the bedrock is increased, can function as a septic tank absorption field. Seepage is a limitation on sites for sewage lagoons. It can be controlled, however, by sealing the sides and bottom of the lagoon with slowly permeable material. Also, sewage can be piped to adjacent areas where the soils are better suited to onsite waste disposal.

Low strength, the shrink-swell potential, and frost action are limitations on sites for local roads and streets. Crushed rock or other suitable material can help to prevent the damage caused by shrinking and swelling and by low strength. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is IIe. No woodland ordination symbol is assigned.

58A—Hartwell silt loam, 0 to 2 percent slopes. This deep, nearly level, somewhat poorly drained soil is on the broad tops of ridges in the uplands. Individual areas generally are long and broad and range from about 10 to more than 800 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 6 inches thick. The subsurface layer is grayish brown, very friable silt loam about 4 inches thick. The subsoil is about 24 inches thick. It is very dark grayish brown, mottled, very firm clay in the upper part and grayish brown, mottled, very firm silty clay in the lower part. The substratum to a depth of 60 inches or more is gray, mottled, firm silty

Figure 10.—Hay bales in an area of Barco sandy loam, 2 to 5 percent slopes. This soil is well suited to hay and pasture.

clay loam. In some eroded areas the surface layer is silt loam less than 8 inches thick or is silty clay loam or silty clay.

Included with this soil in mapping are areas of the moderately well drained Barden soils. These soils are on the higher mounds and in the steeper areas. Also included are soils that have a slightly developed fragipan and a few small areas of soils that have cobbles and stones in the lower part. Included soils make up 5 to 10 percent of the unit.

Permeability is slow in the Hartwell soil. Runoff also is slow. The available water capacity is high. Organic matter content is moderate, and natural fertility is medium. The surface layer is very friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after heavy rains. A perched high water table is at a depth of 0.5 foot to 1.5 feet during most winter and spring months. The shrink-swell potential is high.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and small grain. Erosion and wetness are the main management concerns. The soil tends to remain wet in spring and fall. The wetness often delays planting and harvesting. Insufficient soil moisture during the midsummer dry period commonly is a limitation in areas used for row crops. No-till farming or other kinds of conservation tillage that leave a protective cover of crop residue on the surface conserve moisture and help to prevent excessive erosion. Using crop rotations, returning crop

residue to the soil, and regularly adding other organic material improve fertility, help to prevent crusting, and increase the rate of water infiltration.

This soil is suited to grasses and legumes for pasture and hay. The seasonal wetness and midsummer droughtiness are limitations. Seeding a mixture of shallow-rooted, water-tolerant grasses and clover helps to keep forage production at an acceptable level. Conservation tillage during the initial seeding helps to prevent excessive soil loss. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth.

This soil is suited to building site development. The wetness and the high shrink-swell potential are limitations. Installing tile drains around footings helps to prevent the structural damage caused by excessive wetness. Properly designing dwellings and reinforcing concrete can help to prevent the structural damage caused by shrinking and swelling. The soil is generally unsuitable as a site for septic tank absorption fields because of the wetness and the slow permeability. Properly designed sewage lagoons can function adequately.

Low strength, the shrink-swell potential, frost action, and the wetness are limitations on sites for local roads and streets. Crushed rock or other suitable material can help to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling, frost action, and wetness.

The land capability classification is IIe. No woodland ordination symbol is assigned.

58B2—Hartwell silt loam, 1 to 3 percent slopes, eroded. This deep, very gently sloping, somewhat poorly drained soil is on the tops of ridges and on side slopes in the uplands. Erosion has removed some of the original surface layer. The remaining surface soil is mixed with the subsurface layer and the upper part of the subsoil. Individual areas are irregular in shape and range from about 100 to more than 160 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 7 inches thick. The subsoil is about 41 inches thick. It is very dark grayish brown, mottled, very firm silty clay in the upper part and mottled light gray and yellowish brown, very firm and firm silty clay loam in the lower part. The substratum to a depth of 60 inches or more is similar to the lower part of the subsoil. In some small areas the surface layer is silty clay loam or silty clay. In places the dark surface layer is more than 10 inches thick.

Included with this soil in mapping are small areas of soils that have a slightly developed fragipan and a few small areas of soils that have cobbles and stones in the lower part. Also included are some areas of poorly drained soils in which the surface soil is 26 to 30 inches thick and the upper part of the profile is grayish brown. These soils are on the lower side slopes, near drainageways. Included soils make up about 5 to 10 percent of the unit.

Permeability is slow in the Hartwell soil. Runoff also is slow. The available water capacity is high. Organic matter content is moderate, and natural fertility is medium. The surface layer is very friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after heavy rains. A perched water table is at a depth of 0.5 foot to 1.5 feet in most winter and spring months. The shrink-swell potential is high.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and small grain. Water erosion is the major hazard if cultivated crops are grown. No-till farming or other kinds of conservation tillage that leave a protective cover of crop residue on the surface conserve moisture and help to prevent excessive erosion. If the clayey subsoil is exposed by terracing, tilth deteriorates and the level of fertility and the available water capacity are reduced. These problems can be avoided by stockpiling the topsoil from the area where the terrace will be constructed and redistributing it over the channel area after construction. Using crop rotations and returning crop residue to the soil or regularly adding other organic material improve fertility, help to prevent crusting, and increase the rate of water infiltration. The soil tends to remain wet in spring and fall. The wetness often delays planting and harvesting. Insufficient soil moisture during the midsummer dry period generally is a limitation affecting summer crops. A lower plant population for corn should be considered.

This soil is suited to grasses and legumes for pasture and hay. The seasonal wetness and midsummer droughtiness are limitations. Seeding a mixture of shallow-rooted, water-tolerant grasses and clover helps to keep forage production at an acceptable level. Conservation tillage during the initial seeding helps to prevent excessive soil loss. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth.

This soil is suited to building site development. The

wetness and the high shrink-swell potential are limitations. Installing tile drains around footings helps to prevent the structural damage caused by excessive wetness. Properly designing dwellings and reinforcing footings and foundations with adequately reinforced concrete can help to prevent the structural damage caused by shrinking and swelling. The soil generally is unsuitable as a site for septic tank absorption fields because of the wetness and the slow permeability. Properly designed sewage lagoons can function adequately.

Low strength, the shrink-swell potential, frost action, and the wetness are limitations on sites for local roads and streets. Crushed rock or other suitable material can help to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling, frost action, and wetness.

The land capability classification is IIe. No woodland ordination symbol is assigned.

60B—Barden silt loam, 2 to 5 percent slopes. This deep, gently sloping, moderately well drained soil is on the convex tops and sides of ridges in the uplands. Individual areas generally are irregular in shape and range from about 10 to more than 300 acres in size.

Typically, the surface layer is very dark grayish brown, very friable silt loam about 7 inches thick. The subsoil is about 32 inches thick. It is very dark grayish brown, friable silty clay loam in the upper part; dark brown, mottled, very firm silty clay in the next part; and light brownish gray, mottled, firm silty clay loam in the lower part. The substratum to a depth of 60 inches or more is yellowish brown, mottled, firm silty clay loam. In some eroded areas the surface layer is silty clay loam.

Included with this soil in mapping are small areas of the well drained Barco and Creldon soils and the somewhat poorly drained Hartwell soils. Barco soils are moderately deep. They are on mounds and the lower side slopes. Creldon soils have a fragipan. They are on the lower parts of the landscape. Hartwell soils have more clay than the Barden soil. They are on the broader, nearly level ridgetops. Included soils make up about 5 to 15 percent of the unit.

Permeability is slow in the Barden soil. Surface runoff is medium. The available water capacity is high. Organic matter content is moderately low, and natural fertility is medium. The surface layer is very friable and can be easily tilled throughout a fairly wide range in moisture content. A perched water table is at a depth of 2 to 3 feet in most winter and spring months. The shrink-swell potential is high.

Most areas are used for cultivated crops. This soil is suited to corn, soybeans, grain sorghum, and small grain. Erosion is the major hazard if cultivated crops are grown. No-till farming or other kinds of conservation tillage that leave a protective cover of crop residue on the surface, winter cover crops, grassed waterways, terraces, and contour farming help to prevent excessive soil loss. Using crop rotations and returning crop residue to the soil or regularly adding other organic material improve fertility, minimize crusting, and increase the rate of water infiltration. The soil tends to remain wet in spring and fall. The wetness often delays planting and harvesting.

Many areas are used for pasture or hay. This soil is moderately well suited to most of the cool-season grasses and legumes commonly grown in the county. The suitability for warm-season grasses is fair. The species that are tolerant of wetness grow best. Erosion during seedbed preparation is the main problem. Timely tillage and a quickly established ground cover help to prevent excessive soil loss. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth.

This soil is suited to building site development. The shrink-swell potential and the wetness are limitations. Properly designing dwellings and constructing footings and foundations with adequately reinforced concrete can help to prevent the structural damage caused by shrinking and swelling. Installing tile drains around the footings helps to prevent the structural damage caused by wetness. The soil generally is unsuitable for septic tank absorption fields because of the wetness and the slow permeability. Properly designed sewage lagoons can function adequately.

Low strength, the shrink-swell potential, frost action, and the wetness are limitations on sites for local roads and streets. Crushed rock or other suitable material can help to prevent the damage caused by shrinking and swelling and by low strength. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling, frost action, and wetness.

The land capability classification is IIe. No woodland ordination symbol is assigned.

63B—Lebanon silt loam, 2 to 5 percent slopes. This deep, gently sloping, moderately well drained soil is on the broad tops and upper sides of ridges in the uplands. Individual areas are irregular in shape and

range from about 10 to more than 200 acres in size.

Typically, the surface layer is yellowish brown, very friable silt loam about 6 inches thick. The part of the subsoil above a fragipan is about 18 inches thick. In sequence downward, it is yellowish brown, mottled, friable silty clay loam; strong brown, firm silty clay loam; and yellowish brown, mottled, very firm silty clay. The upper part of the fragipan is light brownish gray, mottled, brittle, very firm silty clay loam. The lower part is light brownish gray and brown, brittle, very firm silty clay loam and cherty silty clay loam. The part of the subsoil below the fragipan to a depth of 60 inches or more is red, firm cherty silty clay.

Included with this soil in mapping are some areas of a somewhat poorly drained soil that does not have a fragipan or has a weakly expressed fragipan. This included soil is in landscape positions similar to those of the Lebanon soil. Also included are small areas of the well drained Bardley and Gepp soils. Bardley soils are moderately deep over limestone. They are in the lower landscape positions. Gepp soils are cherty in the upper part. They are in landscape positions similar to those of the Lebanon soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately slow above the fragipan in the Lebanon soil and very slow in the fragipan. Surface runoff is medium. The available water capacity is moderate. Organic matter content is moderately low, and natural fertility is low. The surface layer is very friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after heavy rains. Root penetration is restricted by the compact fragipan at a depth of about 29 inches. A perched water table is at a depth of 1 to 2 feet in most winter and spring months. The shrink-swell potential is moderate.

This soil is suited to corn, soybeans, and small grain. Erosion is the major hazard if cultivated crops are grown. A system of conservation tillage that leaves a protective cover of crop residue on the surface and winter cover crops help to prevent excessive soil loss. In a few areas slopes are long enough and smooth enough to be farmed on the contour. Returning crop residue to the soil or regularly adding other organic material improves fertility and increases the rate of water infiltration.

Most areas are used for pasture or timber. This soil is suited to most warm-season grasses and to birdsfoot trefoil and is moderately suited to most cool-season grasses and legumes. The moderate rooting depth is a limitation, and droughtiness is a problem during much of the year. Erosion is a major hazard if the soil is tilled during seedbed preparation. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

A few small areas support native hardwoods. This soil is suited to trees. Windthrow is a management concern. The stands should be thinned less intensively and more frequently than the stands in areas where the windthrow hazard is slight. No hazards or limitations affect harvesting.

This soil is suited to building site development. The shrink-swell potential and the wetness are limitations. Properly designing dwellings and constructing footings and foundations with adequately reinforced concrete can help to prevent the structural damage caused by shrinking and swelling. Installing tile drains around the footings helps to prevent the structural damage caused by excessive wetness. The wetness is a limitation on sites for sewage lagoons. Sealing the sides and bottom of the lagoon helps to prevent contamination of the ground water. The soil is generally unsuitable as a site for septic tank absorption fields because of the wetness and the very slow permeability.

Low strength, the shrink-swell potential, frost action, and the wetness are limitations on sites for local roads and streets. Crushed rock or other suitable material can help to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling, frost action, and wetness.

The land capability classification is IIe. The woodland ordination symbol is 3D.

63C—Lebanon silt loam, 5 to 9 percent slopes. This deep, moderately sloping, moderately well drained soil is on the broad tops and upper sides of ridges in the uplands. Individual areas are irregular in shape and range from about 5 to more than 50 acres in size.

Typically, the surface layer is brown, very friable silt loam about 4 inches thick. The subsoil extends to a depth of 60 inches or more. The upper part is strong brown, friable silty clay loam. The next part is dark brown, friable cherty silty clay and a fragipan of mottled, brittle cherty silty clay loam. The lower part is red, firm cherty silty clay and clay.

Included with this soil in mapping are some areas of the well drained Bardley and Goss soils. Bardley soils are on the lower side slopes. Goss soils are along the head of the steeper drainageways and in the steeper

areas. Also included are small areas of the well drained Claiborne soils on foot slopes. Included soils make up 10 to 15 percent of the unit.

Permeability is moderately slow above the fragipan in the Lebanon soil and very slow in the fragipan. Surface runoff is medium. The available water capacity is moderate. Organic matter content is moderately low, and natural fertility is low. The surface layer is very friable and can be easily tilled throughout a fairly wide range in moisture content. It tends to crust or puddle, however, after heavy rains. Root penetration is restricted by the compact fragipan at a depth of about 26 inches. A perched water table is at a depth of 1.5 to 3.0 feet during winter and spring. The shrink-swell potential is moderate.

This soil is suited to corn, soybeans, and small grain. Erosion is the major hazard if cultivated crops are grown. No-till farming or other kinds of conservation tillage that leave a protective cover of crop residue on the surface can help to control erosion, maintain the content of organic matter, improve tilth, increase the rate of water infiltration, and help to maintain fertility.

Most areas are used for pasture or timber. This soil is well suited to most warm-season grasses and birdsfoot trefoil and moderately well suited to most cool-season grasses and legumes. The moderate rooting depth is a limitation, and droughtiness is a problem during much of the year. Erosion is a major hazard if the soil is tilled during seedbed preparation. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

A few areas support native hardwoods. This soil is suited to trees. Windthrow is a management concern. The stands should be thinned less intensively and more frequently than the stands in areas where the windthrow hazard is slight. No hazards or limitations affect harvesting.

This soil is suited to building site development. The shrink-swell potential and the wetness are limitations. Properly designing dwellings and constructing footings and foundations with adequately reinforced concrete can help to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the foundations helps to prevent the structural damage caused by excessive wetness. The slope and the wetness are limitations on sites for sewage lagoons. Sealing the sides and bottom of the lagoon helps to prevent contamination of the ground water. Grading and land shaping help to overcome the slope. The soil is generally unsuitable as a site for septic tank absorption fields because of the wetness and the very slow permeability.

Low strength, the shrink-swell potential, frost action, and the wetness are limitations on sites for local roads and streets. Crushed rock or other suitable material can help to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling, frost action, and wetness.

The land capability classification is IIIe. The woodland ordination symbol is 3D.

64B—Plato silt loam, 1 to 3 percent slopes. This deep, very gently sloping, somewhat poorly drained soil is on the tops of ridges in the uplands. Individual areas are oval and range from about 5 to more than 40 acres in size.

Typically, the surface layer is grayish brown, very friable silt loam about 6 inches thick. The subsurface layer is pale brown, mottled, very friable silt loam about 5 inches thick. The part of the subsoil above a fragipan is about 15 inches thick. It is light yellowish brown and grayish brown, mottled, friable and firm silty clay loam and grayish brown, mottled, very firm silty clay. The fragipan is about 14 inches thick. It is brownish yellow and strong brown, mottled, brittle, very firm silty clay loam in the upper part and strong brown and light gray, brittle, very firm cherty silty clay loam in the lower part. The part of the subsoil below the fragipan extends to a depth of 60 inches or more. It is strong brown and dark red, very firm cherty clay.

Included with this soil in mapping are small areas of the moderately well drained Lebanon soils. These soils are in the more convex areas along the boundary of the map unit. They make up about 10 percent of the unit.

Permeability is moderately slow above the fragipan in the Plato soil and very slow in the fragipan. Surface runoff is slow. The available water capacity is moderate. Natural fertility is low, and organic matter content is moderately low. A perched water table is at a depth of 1.0 to 2.5 feet in most winter and spring months. The shrink-swell potential is moderate in the part of the subsoil above the fragipan. The root zone is limited by the fragipan at a depth of 24 to 32 inches.

This soil is suited to sudangrass, small grain, soybeans, and grain sorghum. The seasonal wetness is a management concern. Surface runoff and seepage collect in depressions. Grading, land smoothing, surface ditches, and tile improve drainage. Insufficient soil moisture during the summer commonly is a limitation. Properly managing crop residue and including cover crops and green manure crops in the cropping system

help to maintain the content of organic matter, improve tilth, and increase the available water capacity.

Most areas are used for fescue pasture or are wooded with post oak and black oak. This soil is moderately well suited to legumes, such as birdsfoot trefoil; to cool-season grasses, such as reed canarygrass and tall fescue; and to warm-season grasses, such as big bluestem, indiangrass, and switchgrass. The limited rooting depth, wetness in spring, and droughtiness in summer are the main problems.

Some areas support stands of native hardwoods. This soil is suited to trees. Windthrow is the main management concern. The stands should be thinned less intensively and more frequently than the stands in areas where the windthrow hazard is slight.

This soil is suited to building site development. The wetness and the shrink-swell potential are limitations. Properly designing dwellings and constructing foundations and footings with adequately reinforced concrete can help to prevent the structural damage caused by shrinking and swelling. Installing drainage tile around the foundations helps to prevent the damage caused by excessive wetness.

Low strength, the shrink-swell potential, frost action, and the wetness are limitations on sites for local roads and streets. Crushed rock or other suitable material can help to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling, frost action, and wetness.

The land capability classification is IIs. The woodland ordination symbol is 3D.

66C—Gepp very cherty silt loam, 3 to 9 percent slopes. This deep, gently sloping and moderately sloping, well drained soil is on narrow, convex ridgetops and short, uneven side slopes in the uplands. Individual areas are irregular in shape and range from about 10 to more than 100 acres in size.

Typically, the surface layer is dark grayish brown, very friable very cherty silt loam about 5 inches thick. The subsurface layer is pale brown, very friable very cherty silt loam about 8 inches thick. The subsoil extends to a depth of 60 inches or more. It is yellowish red, mottled, very firm cherty clay in the upper part and red, mottled, very firm clay in the lower part. In some areas the soil has less chert and has a surface layer of loam.

Included with this soil in mapping are small areas of Bardley, Goss, and Lebanon soils. Bardley and Goss soils are in landscape positions similar to those of the Gepp soil. Bardley soils are moderately deep over limestone or dolomite bedrock. Goss soils have chert throughout. They are steeper than the Gepp soil. The moderately well drained Lebanon soils are on the broader ridgetops. They have a fragipan. Included soils make up 5 to 10 percent of the unit.

Permeability is moderate in the Gepp soil. Surface runoff is medium. The available water capacity is low. Organic matter content and natural fertility also are low. Root penetration is restricted because the root zone is very strongly acid. The shrink-swell potential is moderate.

Most areas are used for pasture or timber. This soil is moderately suited to crownvetch, lespedeza, tall fescue, and all of the warm-season grasses commonly grown in the county. Erosion and the chert fragments in the surface layer are the main management concerns. Tillage should be restricted to periods when the pasture is to be reseeded. The soil generally is unsuitable as hayland because of the chert fragments on the surface. Droughtiness is often a problem during the summer.

A few areas support native hardwoods. This soil is suited to trees. Tree seeds, cuttings, and seedlings survive and grow well if competing plants are controlled by proper site preparation, which may include spraying or cutting. No other major hazards or limitations affect planting or harvesting.

This soil is suitable for building site development. The shrink-swell potential is a limitation. Foundations and footings should be properly designed and should be constructed with adequately reinforced concrete. These measures help to prevent the structural damage caused by shrinking and swelling. The moderate permeability is a limitation on sites for septic tank absorption fields. Enlarging the absorption field helps to overcome this limitation. The soil is suitable as a site for sewage lagoons if extra soil material can be hauled in and the site is graded. Sealing the bottom and sides of the lagoon helps to prevent seepage.

Low strength, the shrink-swell potential, and frost action are limitations on sites for local roads and streets. Crushed rock or other suitable material can help to prevent the damage caused by shrinking and swelling and by low strength. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is IVe. The woodland ordination symbol is 4A.

67C—Bardley very cherty silt loam, 3 to 9 percent slopes. This moderately deep, gently sloping and moderately sloping, well drained soil is on the convex tops and sides of ridges in the uplands. Individual areas are irregular in shape and generally range from about 5 to more than 200 acres in size.

Typically, the surface layer is dark brown, very friable very cherty silt loam about 5 inches thick. The subsurface layer is dark yellowish brown, very friable very cherty silt loam about 9 inches thick. The subsoil is about 13 inches thick. It is red, very firm cherty clay in the upper part and strong brown, very firm clay in the lower part. Dolomite or limestone bedrock is at a depth of about 27 inches. In places the subsoil is yellowish brown and is not so clayey. In some small areas the soil is 40 to 60 inches deep over bedrock.

Included with this soil in mapping are small areas where limestone crops out and small areas of Gepp soils, the somewhat excessively drained Gasconade soils, and the moderately well drained Lebanon soils. Gepp soils are deeper than the Bardley soil. They are in landscape positions similar to those of the Bardley soil. The shallow Gasconade soils and the rock outcrop are in the steeper areas interspersed throughout the unit. Lebanon soils have a fragipan. They are on the broad tops of ridges. Included areas make up about 10 to 15 percent of the unit.

Permeability is moderate in the Bardley soil. Surface runoff is rapid. The available water capacity is low. Organic matter content and natural fertility also are low. Root penetration is restricted by the limestone bedrock at a depth of 20 to 40 inches. The shrink-swell potential is moderate.

Most areas are used for timber or pasture. This soil is well suited to most warm-season grasses and to birdsfoot trefoil and is moderately well suited to most cool-season grasses and legumes. The moderate rooting depth is a limitation, and droughtiness is often a problem during the summer. Tillage should be avoided. Erosion is a major hazard if the soil is tilled during seedbed preparation. Timely tillage and a quickly established ground cover help to prevent excessive soil loss.

Many areas support native hardwoods. This soil is suited to trees, but windthrow and seedling mortality are management concerns. The stands should be thinned less intensively and more frequently than the stands in areas where the windthrow hazard is slight. Planting nursery stock that is larger than is typical or that is container grown increases the seedling survival rate.

This soil is suited to building site development. It is better suited to buildings without basements than to buildings with basements. The shrink-swell potential and the depth to bedrock are limitations. Properly designing dwellings and reinforcing footings and foundations with adequately reinforced concrete can help to prevent the structural damage caused by shrinking and swelling. Some excavation of the bedrock may be needed. The excavated areas should be backfilled with soil material. The soil generally is not suitable as a site for septic tank absorption fields because of the depth to bedrock and seepage. Sewage lagoons function best if the site is leveled and extra soil material is available for the berms. Sealing the bottom of the lagoon helps to prevent seepage.

Low strength, the shrink-swell potential, and frost action are limitations on sites for local roads and streets. Crushed rock or other suitable material can help to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is IVe. The woodland ordination symbol is 2D.

67F—Bardley very cherty silt loam, 9 to 50 percent slopes. This moderately deep, strongly sloping to very steep, well drained soil is on side slopes in the uplands. Individual areas are irregular in shape and range from about 5 to more than 80 acres in size.

Typically, the surface layer is very dark grayish brown, very friable very cherty silt loam about 4 inches thick. The subsurface layer is yellowish brown, friable very cherty silt loam about 8 inches thick. The subsoil is about 18 inches thick. It is mixed red, yellowish brown, and reddish brown, firm clay in the upper part and mixed yellowish brown, weak red, and red, very firm clay and cherty clay in the lower part. Dolomite or limestone bedrock is at a depth of about 30 inches. In some small areas the soil is 40 to 60 inches deep over bedrock. In other small areas it is not cherty.

Included with this soil in mapping are small areas where limestone crops out and small areas of the deep Gepp and Goss soils and the somewhat excessively drained Gasconade soils. Gepp soils are on the upper parts of the landscape. The shallow Gasconade soils and the rock outcrop are in scattered areas throughout the unit. Goss soils are in landscape positions similar to those of the Bardley soil. Included areas make up 10 to 15 percent of the unit.

Permeability is moderate in the Bardley soil. Surface runoff is rapid. The available water capacity is low.

Organic matter content and natural fertility also are low. Root penetration is restricted by the limestone bedrock at a depth of 20 to 40 inches. The shrink-swell potential is moderate.

Most areas are used for timber. Many areas support native hardwoods. This soil is suited to trees. The erosion hazard, the equipment limitation, seedling mortality, and windthrow are management concerns. The stands should be thinned less intensively and more frequently than the stands in areas where the windthrow hazard is slight. Planting nursery stock that is larger than is typical or that is container grown increases the seedling survival rate. Seedlings cannot be planted by machine in some areas because of the chert in the surface layer. Logging roads and skid trails should be built on the contour. In the steepest areas it may be necessary to yard logs uphill to logging roads and skid trails.

Some areas are used for pasture. This soil is well suited to most warm-season grasses and to birdsfoot trefoil and is moderately well suited to cool-season grasses and legumes. Erosion is a major hazard if the soil is tilled during seedbed preparation. Timely tillage and a quickly established ground cover help to prevent excessive soil loss. The moderate rooting depth is a limitation, and insufficient soil moisture is common during the summer.

The steeper areas of this soil generally are unsuitable for building site development and onsite waste disposal because of the slope.

The land capability classification is VIIe. The woodland ordination symbol is 2R.

68C—Eldon cherty silt loam, 3 to 9 percent slopes. This deep, gently sloping and moderately sloping, well drained soil is on the convex tops and sides of ridges in the uplands. Chert fragments 3 to 10 inches in size cover 0.1 to 0.5 percent of the surface. Individual areas are irregular in shape and range from about 5 to 160 acres in size.

Typically, the surface layer is very dark grayish brown, very friable cherty silt loam about 6 inches thick. The subsurface layer is dark brown, very friable cherty silt loam about 4 inches thick. The subsoil extends to a depth of 60 inches or more. It is dark yellowish brown and yellowish red, friable and firm very cherty and extremely cherty silty clay loam in the upper part and red, firm and very firm cherty silty clay and cherty clay in the lower part. In some areas the soil has a thinner dark surface layer. In other areas it is stony.

Included with this soil in mapping are areas of the moderately well drained Creldon soils, areas of Goss soils, and areas of the somewhat poorly drained Sampsel soils. Creldon soils have a fragipan. They are on the tops of ridges above the Eldon soil. Goss soils have a light colored surface layer. They are in the steeper areas. Sampsel soils are less cherty than the Eldon soil. They are on the lower slopes. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Eldon soil. Surface runoff is medium. The available water capacity is moderate. Organic matter content also is moderate, and natural fertility is medium. The shrink-swell potential is moderate.

Most areas are used for pasture, hay, or small grain. Many support native warm-season grasses. This soil is well suited to grasses and legumes for pasture and hay. Erosion and the chert fragments in the surface layer are the main management concerns. Timely minimum tillage helps to prevent excessive erosion when the pasture is seeded. Insufficient soil moisture is common during the summer.

This soil is suited to building site development. The shrink-swell potential is a limitation. Properly designing dwellings and constructing footings and foundations with adequately reinforced concrete can help to prevent the structural damage caused by shrinking and swelling. The moderate permeability is a limitation on sites for septic tank absorption fields. Enlarging the absorption fields helps to overcome this limitation. Leveling sites for sewage lagoons and sealing the berms and bottom of the lagoon with slowly permeable material help to prevent seepage and the contamination of ground water.

Low strength, the shrink-swell potential, and frost action are limitations on sites for local roads and streets. Crushed rock or other suitable material can help to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action.

The land capability classification is IVs. No woodland ordination symbol is assigned.

68D—Eldon cherty silt loam, 9 to 14 percent slopes. This deep, strongly sloping, well drained soil is on side slopes in the uplands. Chert fragments 3 to 10 inches in size cover 0.1 to 0.5 percent of the surface. Individual areas are irregular in shape and range from about 5 to 80 acres in size.

Typically, the surface layer is very dark grayish brown, very friable cherty silt loam about 6 inches thick.

The subsurface layer is dark brown, very friable cherty silt loam about 4 inches thick. The subsoil is about 63 inches thick. It is dark red, firm cherty silty clay in the upper part; dark red, mottled, firm cherty clay in the next part; and dark yellowish brown, mottled, very firm cherty clay in the lower part. In some areas the soil is stony.

Included with this soil in mapping are areas of the moderately well drained Creldon soils, areas of Goss soils, and areas of the well drained Claiborne soils. Creldon soils have a fragipan. They are on narrow ridgetops. Goss soils have a surface layer that is lighter colored than that of the Eldon soil. They are in the steeper areas. Claiborne soils are on foot slopes below the Eldon soil. Included soils make up 10 to 15 percent of the unit.

Permeability is moderate in the Eldon soil. Surface runoff is rapid. The available water capacity is moderate. Organic matter content also is moderate, and natural fertility is medium. The shrink-swell potential is moderate.

Most areas are used as hayland and pasture. Some areas support native warm-season grasses. This soil is moderately suited to crownvetch, lespedeza, tall fescue, and all of the commonly grown warm-season grasses. Erosion and the chert fragments in the surface layer are the main management concerns. Timely minimum tillage helps to prevent excessive erosion when the pasture is seeded. Insufficient soil moisture is common during the summer.

This soil is suited to building site development and onsite waste disposal. The moderate permeability, the shrink-swell potential, and the slope are limitations. Properly designing dwellings and constructing footings and foundations with adequately reinforced concrete can help to prevent the structural damage caused by shrinking and swelling. The slope can be overcome by land shaping and by designing buildings so that they conform to the natural slope of the land. Enlarging septic tank absorption fields helps to overcome the moderate permeability. Land shaping and installing the distribution lines on the contour help to prevent downhill seepage and improve the efficiency of the absorption system. Leveling sites for sewage lagoons and sealing the berms and bottom of the lagoon with slowly permeable material help to prevent seepage and the contamination of ground water.

Low strength, the shrink-swell potential, frost action, and the slope are limitations on sites for local roads and streets. Crushed rock or other suitable material can help to prevent the damage caused by low strength. Grading the roads and streets so that they shed water, constructing adequate roadside ditches, and installing culverts improve drainage and thus minimize the damage caused by shrinking and swelling and by frost action. The roads and streets should be built on the contour.

The land capability classification is VIs. No woodland ordination symbol is assigned.

72C—Gasconade-Rock outcrop complex, 3 to 9 percent slopes. This map unit is on the tops of ridges, in saddles, and on side slopes in the uplands. The shallow, gently sloping and moderately sloping, somewhat excessively drained Gasconade soil is in areas between ledges of Rock outcrop. Most areas are irregular in shape and range from about 5 to more than 80 acres in size. They are about 65 percent Gasconade soil and 25 percent Rock outcrop. The Gasconade soil and the Rock outcrop occur as areas so intermingled that they could not be mapped separately at the scale selected for mapping.

Typically, the surface layer of the Gasconade soil is very dark brown, firm flaggy silty clay loam about 5 inches thick. The subsoil is very dark brown, very firm very flaggy silty clay loam about 8 inches thick. Limestone bedrock is at a depth of about 13 inches.

The Rock outcrop is limestone or dolomite bedrock. As much as 3 inches of soil material similar to the surface layer of Gasconade soil covers the bedrock in places.

Included with the Gasconade soil and Rock outcrop in mapping are small areas of the well drained Bardley and Gepp soils and the very shallow Knobby soils. Bardley and Gepp soils are around the edges of the mapped areas. Knobby soils are in landscape positions similar to those of the Gasconade soil. Included soils make up about 10 percent of the unit.

Permeability is moderately slow in the Gasconade soil. Surface runoff is rapid. The available water capacity is very low. Organic matter content is moderate, and natural fertility is low. Root penetration is restricted by the hard bedrock at a depth of about 13 inches.

Most areas are used as woodland (fig. 11) or pasture. The Rock outcrop supports little or no vegetation. The Gasconade soil supports native plants. In some areas it has dense stands of redcedar and scrub oak. Alsike clover, big bluestem, little bluestem, and indiangrass are the most productive forage species on this shallow, droughty soil. The surface layer commonly is flaggy or cobbly. The stones and the Rock outcrop limit the use of equipment.

The Gasconade soil is poorly suited to hardwoods

Figure 11.—Cedar logs cut mainly from an area of Gasconade-Rock outcrop complex, 3 to 9 percent slopes.

because of the shallowness to bedrock. Eastern redcedar grows best. Because of low production, commercial timber management generally is not feasible. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Overcoming these limitations is difficult.

The Gasconade soil has poor potential for most types of upland game habitat, but it provides an edge habitat for wildlife species. The native grasses and redcedar provide most of the food and cover.

The Gasconade soil generally is unsuitable for building site development and onsite waste disposal because of the shallowness to bedrock. Building site development is limited by the cost of excavating the bedrock.

The Gasconade soil is assigned to land capability

classification VIs and woodland ordination symbol 2D. The Rock outcrop is not assigned a land capability classification or a woodland ordination symbol.

72F—Gasconade-Rock outcrop complex, 9 to 50 percent slopes. This map unit is on side slopes in the uplands. It is on bluffs and in steep areas adjacent to streams. The shallow, strongly sloping to very steep, somewhat excessively drained Gasconade soil is in areas between ledges of Rock outcrop. Individual areas are irregularly shaped or long and narrow and range from about 5 to more than 200 acres in size. They are about 60 percent Gasconade soil and 30 percent Rock outcrop. The Gasconade soil and the Rock outcrop occur as areas so intermingled that they could not be mapped separately at the scale selected for mapping.

Typically, the surface layer of the Gasconade soil is very dark brown, firm flaggy silty clay loam about 5 inches thick. The subsoil is very dark grayish brown, firm very flaggy silty clay loam about 8 inches thick. Limestone bedrock is at a depth of about 13 inches.

The Rock outcrop is limestone or dolomite bedrock. As much as 3 inches of soil material similar to the surface layer of the Gasconade soil covers the bedrock in places.

Included with the Gasconade soil and Rock outcrop in mapping are small areas of the moderately deep Bardley and deep Gepp and Goss soils. These soils are well drained and are around the edges of the mapped areas. Also included are areas of the very shallow Knobby soils, which are in landscape positions similar to those of the Gasconade soil. Included soils make up about 10 percent of the unit.

Permeability is moderately slow in the Gasconade soil. Surface runoff is rapid. The available water capacity is very low. Organic matter content is moderate, and natural fertility is low. The surface layer is friable, but it cannot be easily tilled because it is flaggy. Root penetration is restricted by the hard bedrock at a depth of about 13 inches.

Most areas are used as woodland. The Rock outcrop supports little or no vegetation. The Gasconade soil supports native pasture plants and redcedar. Alsike clover, big bluestem, little bluestem, and indiangrass are the most productive forage species on this shallow, droughty soil. The surface layer commonly is flaggy or gravelly. The stones, the slope, and the Rock outcrop limit the use of equipment.

The Gasconade soil is poorly suited to hardwoods because of the shallowness to bedrock. Eastern redcedar grows best. Because of low production, commercial timber management generally is not feasible. The equipment limitation, seedling mortality, and the windthrow hazard are management concerns. Overcoming these limitations is difficult.

The Gasconade soil has poor potential for most types of upland game habitat, but it provides an edge habitat for wildlife species. The native grasses and redcedar provide most of the food and cover.

The Gasconade soil generally is unsuitable for building site development and onsite waste disposal because of the slope and the shallowness to bedrock. Building site development is limited by the cost of excavating the bedrock.

The Gasconade soil is assigned to land capability classification VIIs and woodland ordination symbol 2R. The Rock outcrop is not assigned a land capability classification or a woodland ordination symbol.

74C—Knobby-Rock outcrop complex, 3 to 9 percent slopes. This map unit is on the tops of ridges, in saddles, and on side slopes in the uplands. The very shallow, gently sloping and moderately sloping, well drained Knobby soil is in isolated grassy glades between ledges of Rock outcrop. Individual areas generally are irregular in shape and range from about 5 to more than 30 acres in size. They are about 65 percent Knobby soil and 20 percent Rock outcrop. The Knobby soil and the Rock outcrop occur as areas so intermingled that they could not be mapped separately at the scale selected for mapping.

Typically, the surface layer of the Knobby soil is very dark grayish brown, very friable very cobbly loam about 5 inches thick. The subsurface layer also is very dark grayish brown, very friable very cobbly loam. It is about 4 inches thick. Dolomite bedrock is at a depth of about 9 inches.

The Rock outcrop is dolomite bedrock. As much as 3 inches of soil material similar to the surface layer of the Knobby soil covers the bedrock in places.

Included with the Knobby soil and Rock outcrop in mapping are small areas of the moderately deep Bardley and shallow Gasconade soils. These soils are around the edges of the mapped areas. They make up about 15 percent of the unit.

Permeability is moderate in the Knobby soil. Surface runoff is rapid. The available water capacity is very low. Organic matter content is moderately low, and natural fertility is low. The surface layer is friable, but it cannot be easily tilled because it is cobbly. Root penetration is restricted by the hard bedrock at a depth of about 9 inches.

Most of the acreage is idle grassland. The Rock outcrop supports little or no vegetation. The Knobby soil

Figure 12.—Native warm-season grasses in an area of Knobby-Rock outcrop complex, 3 to 9 percent slopes.

supports native pasture plants (fig. 12) and a few scattered redcedars. In some areas it supports only native grasses. It is poorly suited to hay and pasture. The very cobbly surface layer and the Rock outcrop limit the use of equipment.

The Knobby soil is poorly suited to hardwoods because of the shallowness to bedrock. Because of the Rock outcrop and the very cobbly surface layer, commercial timber management generally is not feasible.

The Knobby soil generally is unsuitable for building site development and onsite waste disposal because of the shallowness to bedrock. Building site development is limited by the cost of excavating the bedrock.

The Knobby soil is assigned to land capability classification VIs and woodland ordination symbol 2F. The Rock outcrop is not assigned a land capability classification or a woodland ordination symbol.

74F—Knobby-Rock outcrop complex, 9 to 50 percent slopes. This map unit is on side slopes in the uplands. The very shallow, strongly sloping to steep, well drained Knobby soil is in isolated grassy glades between ledges of Rock outcrop. Individual areas are irregular in shape and range from 5 to more than 100 acres in size. They are about 70 percent Knobby soil

and 20 percent Rock outcrop. The Knobby soil and the Rock outcrop occur as areas so intermingled that they could not be mapped separately at the scale selected for mapping.

Typically, the surface layer of the Knobby soil is very dark grayish brown, very friable very cobbly loam about 5 inches thick. The subsurface layer also is very dark grayish brown, very friable very cobbly loam. It is about 4 inches thick. Dolomite bedrock is at a depth of about 9 inches.

The Rock outcrop is dolomite. As much as 3 inches of soil material similar to the surface layer of the Knobby soil covers the bedrock in places.

Included with the Knobby soil and Rock outcrop in mapping are small areas of the moderately deep Bardley and shallow Gasconade soils. These soils are around the edges of the mapped areas. They make up about 10 percent of the unit.

Permeability is moderate in the Knobby soil. Surface runoff is rapid. The available water capacity is very low. Organic matter content is moderately low, and natural fertility is low. The surface layer is friable, but it cannot be easily tilled because it is cobbly. Root penetration is restricted by the hard bedrock at a depth of about 9 inches.

Most areas are used as pasture. The Rock outcrop supports little or no vegetation. The Knobby soil supports native pasture plants and a few scattered redcedars and scrub oaks. In some areas it supports only native grasses. It is poorly suited to hay and pasture. The slope, the very cobbly surface layer, and the Rock outcrop limit the use of equipment.

The Knobby soil is poorly suited to hardwoods because of the shallowness to bedrock. Because of the slope, the Rock outcrop, and the very cobbly surface layer, commercial timber management generally is not feasible.

The Knobby soil generally is unsuitable for building site development and onsite waste disposal because of the shallowness to bedrock. Building site development is limited by the slope and the cost of excavating the bedrock.

The Knobby soil is assigned to land capability classification VIIs and woodland ordination symbol 2F. The Rock outcrop is not assigned a land capability classification or a woodland ordination symbol.

Prime Farmland

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is the land that is best suited to food, feed, forage, fiber, and oilseed crops. It may be cultivated land, pasture, woodland, or other land, but it is not urban or built-up land or water areas. It either is used for food or fiber crops or is available for those crops. The soil qualities, growing season, and moisture supply are those needed for a well managed soil to produce a sustained high yield of crops in an economic manner. Prime farmland produces the highest yields with minimal expenditure of energy and economic resources, and farming it results in the least damage to the environment.

Prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The level of acidity or alkalinity is acceptable. Prime farmland has few or no rocks and is permeable to water and air. It is not excessively erodible or saturated with water for long periods and is not frequently flooded during the growing season. Slopes range mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Soil Conservation Service.

About 80,950 acres in the county, or nearly 31 percent of the total acreage, meets the requirements for prime farmland. Scattered areas of this land are throughout the county. Most are in the western part, mainly in association 4, which is described under the heading "General Soil Map Units." The chief cultivated crops grown on this land are corn, grain sorghum, and soybeans. They account for an estimated 10 percent of the county's total agricultural income each year. The major part of the prime farmland is used for hay or pasture in beef or dairy cattle enterprises.

The map units in the county that are considered prime farmland are listed in table 5. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

Some soils that have a seasonal high water table

qualify for prime farmland only in areas where this limitation has been overcome by drainage measures. The need for these measures is indicated after the map unit name in table 5. Onsite evaluation is needed to determine whether or not this limitation has been overcome by corrective measures.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the county. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavior characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in the county. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

Jess C. Epple, Jr., district conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the county, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

About one-fifth of the acreage in the county is cropland or pasture. Corn, soybeans, winter wheat, and grain sorghum are the main cultivated crops. Tall fescue, native grasses, orchardgrass, alfalfa, lespedeza, red clover, and sudangrass are the major forage plants.

The major concerns in managing the soils in the county for crops and pasture are water erosion, wetness in spring, and droughtiness in summer. On all of the soils, measures that conserve moisture, maintain or increase the organic matter content, and maintain or improve fertility and tilth are needed. A combination of measures is needed to control erosion.

Good management significantly increases crop and pasture yields. The management practices needed on most of the soils that are suited to crops and pasture are described in the following paragraphs.

High fertility levels increase the yields of grain and forage crops. The kinds and amounts of soil amendments needed to maintain or increase fertility levels can be determined by soil tests. A complete record of the kind and amount of fertilizer applied, the time of application, and the yields obtained is desirable.

Close-growing crops reduce the destructive impact of falling raindrops on the soil. Leaving large amounts of crop residue on the surface after harvesting can increase the organic matter content and keep the soil porous, thereby increasing the rate of water intake and the available water capacity. Also, it helps to control runoff and erosion. The effectiveness in controlling erosion depends on the amount of residue and the

length of time it is left on the surface. Thus, spring plowing, which allows residue to remain on the surface throughout the winter, is more effective than fall plowing, which leaves the surface bare in winter. The use of tillage implements that leave crop residue on the surface throughout the winter and during the growing season is most desirable.

No-till farming or another kind of conservation tillage helps to maintain good tilth, increases the rate of water infiltration, and reduces the hazard of erosion. It includes the use of chisel plows, disk or field cultivators, or other implements that minimize tillage. At least 30 percent of the surface is covered by crop residue after planting.

If specially managed, some soils can be intertilled year after year without excessive erosion. These include the soils on bottom land and some of the nearly level soils on uplands. The special management in intensively cropped areas generally includes measures that maintain fertility, proper management of crop residue, and no-till farming or minimum tillage. These measures are used in combination with grassed waterways, vegetative strips, terraces, and diversion terraces on uplands and with drainage systems in some areas on bottom land.

Grassed waterways are effective in controlling erosion where runoff accumulates in natural drainageways. If properly located, they serve as terrace outlets where terraces are needed. They can be designed so that they can be crossed by large farm machinery. Some soils are shallow or moderately deep to a clayey subsoil or to rocky layers. Examples are Barden, Creldon, and Hartwell soils. On these soils topsoil should be stockpiled and spread over the waterways after they have been shaped.

If cultivated, the more sloping soils are subject to erosion. Field terraces reduce the length of slopes and thus are effective erosion-control measures on cultivated soils that have slopes of more than 2 percent. Soils having slopes that are less than 2 percent but are 120 feet or more long generally should be terraced and farmed on the contour. If nearly parallel terraces are constructed, excessive point rows are eliminated and farming is easier.

In nearly level areas of Hartwell soils and in some gently sloping areas of Barden soils, farming up and down the slope has increased the runoff rate. In these areas severely eroded strips start near the top of ridges or near fences or roads and continue down the slope for 700 to 800 feet. These areas are several hundred feet wide. Sheet erosion in these areas can be controlled by crop rotations that include small grain or meadow crops, by no-till farming or another conservation tillage system, by contour farming, and in places by terraces.

Many good stands of high-yielding pasture grasses and legumes have been established in the county. Pasture renovation and improved management are needed to control erosion and increase forage yields.

On Eldon and Gepp soils and in some areas of Bardley, Creldon, and Lebanon soils, scattered rocks are on the surface. Landowners have picked the rocks out of the hay and pasture fields and hauled them to ditches and other areas. As a result, these soils are better suited to pasture and hay.

Proper management of permanent pasture increases the life of the stand, maintains the quality and quantity of the forage, helps to protect the soil, and reduces water loss. Some important management practices are proper stocking rates, a minimum grazing height, applications of plant nutrients, and rest periods during the grazing season and prior to frost in the fall. Weed control, freeze-protected watering tanks, and rotation grazing also are important.

In some areas fescue endophyte (fungus) is a problem. Planting clover in the fescue stand can improve the quality of the forage. Some fescue seed varieties are endophyte resistant. Landowners can kill their fescue with approved chemicals and establish other grasses, such as warm-season grasses and orchardgrass.

A well managed pasture generally includes mixtures of cool-season grasses and legumes, which can be grazed in spring and fall. Tall fescue can be stockpiled for use in winter by beef cattle and other animals. In spring surplus grasses and legumes can be round-baled and left in the field to extend the grazing season and maintain the quality of the feed. Growing warm-season grasses, such as bluestems, indiangrass, and switchgrass, can meet the need for good-quality summer forage. When warm-season grasses are grown for pasture and hay, prescribed burning is needed to control weeds, stimulate grass seed production, and prevent excessive accumulation of plant residue.

Technical assistance in planning the management of a particular field or farm can be obtained from the Soil Conservation Service through the Hickory County Soil and Water Conservation District.

Yields Per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table

because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

Crops other than those shown in table 6 are grown in the county, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for woodland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit *(8)*. Only class and subclass are used in this survey.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

Class VI soils have severe limitations that make them generally unsuitable for cultivation.

Class VII soils have very severe limitations that make them unsuitable for cultivation.

Class VIII soils and miscellaneous areas have limitations that nearly preclude their use for commercial crop production.

There are no class I, class V, or class VIII soils in Hickory County.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, or *s*, to the class numeral, for example, IIe. The letter *e* shows that the main hazard is the risk of water erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); and *s* shows that the soil is limited mainly because it is shallow, droughty, or stony.

The capability classification of each map unit, except for Pits and dumps and Udorthents, clayey, is given in the section "Detailed Soil Map Units" and in table 6.

Woodland Management and Productivity

James L. Robinson, forester, Soil Conservation Service, helped prepare this section.

Approximately 35 percent of the land area in Hickory County is forested. The Bardley-Lebanon-Gepp, Bardley-Gasconade, and Goss-Gasconade associations have significant amounts of forest cover. The major timber type is white oak-northern red oak-hickory. Many other species grow on these associations. The more common ones are black oak, post oak, chinkapin oak,

shingle oak, white ash, sugar maple, elm, and black walnut. The dominant species on the Gasconade soils commonly is eastern redcedar. These soils are best suited to this species. The Gepp and Goss soils and the minor soils in these associations support stands of white oak, northern red oak, walnut, and hickories on the north- and east-facing slopes. If well managed, these soils can produce high-quality trees.

South- and west-facing slopes are droughty sites on which tree growth is marginal. The dominant species are post oak, chinkapin oak, black oak, eastern redcedar, and shagbark hickory. The potential for timber on these sites is limited and warrants only low-investment management.

The Racket-Claiborne-Ashton association is on flood plains and on side slopes and foot slopes adjacent to stream valleys. It is forested in narrow strips along the riparian areas of the major rivers and tributaries. Many areas are frequently flooded, and some areas are not adequately drained for crop production. Typical tree species include cottonwood, silver maple, black willow, green ash, hackberry, black walnut, American elm, and boxelder. The Ashton and Racket soils are excellent sites for black walnut. They are highly productive and respond well to intensive forest management.

Only a small acreage of the Hartwell-Eldon-Barden and Eldon-Creldon associations is forested. The dominant natural vegetation on these associations was prairie grasses. Timber, mainly post oak, white oak, hickories, and blackjack oak, grew in the drainageways.

Knowledge of soils helps to provide a basic understanding of how forest types develop and tree growth occurs. White oak grows well on deep, moist soils. Hickories, post oak, and chinkapin oak are more prevalent where the rooting depth or moisture supply is limited. The soil serves as a reservoir for moisture, provides an anchor for tree roots, and supplies most of the available plant nutrients. The soil properties that directly or indirectly affect these growth requirements include reaction, fertility, drainage, texture, structure, and depth. Landscape position also is important.

Available water capacity is influenced primarily by texture, rooting depth, and content of stones, shale, and chert. Deep soils that have a surface layer of silt loam or loam, such as Racket soils, have a high available water capacity. The depth to bedrock affects the amount of available water in Gasconade soils and restricts root development. These limitations reduce the productive potential of the site. They can be minimized by managing for the species best suited to these conditions.

The supply of plant nutrients affects tree growth. Many soils on uplands have a leached subsoil that contains few nutrients. Most of the soils on bottom land have a substratum that contains larger amounts of nutrients.

The layer of leaf litter on the surface is as important as the mineral horizons below the surface. Decomposition of this layer recycles the nutrients that have accumulated in the forest ecosystem over long periods. Fire or excessive erosion can result in the loss of these nutrients. Forest management should include the prevention of wildfires and measures that protect the woodland from overgrazing.

Other site characteristics that affect tree growth include aspect and position on the landscape. These influence such factors as the amount of available sunlight, air drainage, soil temperature, and moisture supply. North- and east-facing slopes are generally the best upland sites for tree growth.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for an indicator tree species. The number indicates the volume, in cubic meters per hectare per year, which the indicator species can produce. The number 1 indicates low potential productivity; 2 and 3, moderate; 4 and 5, moderately high; 6 to 8, high; 9 to 11, very high; and 12 to 39, extremely high. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *R* indicates steep slopes; *X*, stoniness or rockiness; *W*, excess water in or on the soil; *T*, toxic substances in the soil; *D*, restricted rooting depth; *C*, clay in the upper part of the soil; *S*, sandy texture; *F*, a high content of rock fragments in the soil, and *L*, low strength. The letter *A* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, F, and L.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, fire lanes, and log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the

slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment or season of use is not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Windthrow hazard is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It is the dominant species on the soil and the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Windbreaks and Environmental Plantings

James L. Robinson, forester, Soil Conservation Service, helped prepare this section.

In many areas of the county, especially the prairie areas in the Hartwell-Eldon-Barden and Eldon-Creldon associations, farmstead or feedlot windbreaks should be established. Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, help to keep snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To ensure plant survival, a healthy planting stock of suitable species should be planted properly on

a well prepared site and maintained in good condition.

Table 8 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 8 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a commercial nursery.

Recreation

Christopher J. Dalton, wildlife biologist, Missouri Department of Conservation, helped prepare this section.

The Truman Reservoir has provided opportunities for recreation to residents and visitors of this part of Missouri. Truman Lake has 55,600 acres of surface water. About 54,000 acres of public land is adjacent to the lake. The Pomme de Terre Reservoir area includes 7,820 acres of surface water and nearly 7,000 acres of public land. The recreational facilities around these reservoirs include campgrounds, swimming areas, boat-launching sites, marina concessions, nature interpretive centers, natural areas, a visitor center, picnic areas, and ballfields. Hunting and fishing are allowed on all government land, except for park and refuge areas and s tes posted for security and safety.

The soils of the county are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties generally are favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils are gently sloping and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones and boulders, is firm after rains, and is not dusty when dry. If grading is needed, the depth of the soil over bedrock or a hardpan should be considered.

Paths and trails for hiking and horseback riding should require little or no cutting and filling. The best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes and few or no stones or boulders on the surface.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Figure 13.—An area of a Gasconade-Rock outcrop complex in the foreground and a Bardley very cherty silt loam in the background. This area provides good edge habitat for deer.

Wildlife Habitat

Christopher J. Dalton, wildlife biologist, Missouri Department of Conservation, helped prepare this section.

Hickory County is among the 13 counties in Missouri that make up the West Ozark Border Zoogeographic Region. Approximately 10 percent of the acreage in the county is cropland, 55 percent is grassland, and 35 percent is woodland, which includes areas of small shrubs and brush. This distribution of land uses favors both openland and woodland wildlife. Deer and turkey are the most popular game species in the county. The population of nongame species, such as songbirds, is good to excellent in each of the soil associations described under the heading "General Soil Map Units." The chief problems in managing the wildlife habitat in the county are a fescue monoculture, the limited availability of row crops, and the loss of wooded fence rows between fields and grazed woodland.

Most of the woodland in the county is in areas of the Bardley-Gasconade, Goss-Gasconade, and Bardley-Lebanon-Gepp associations. The deer population is excellent, and estimates show that the carrying capacity for this big game animal has nearly been reached (fig. 13). The turkey population is good and is increasing. Hunter interest in both deer and turkey is high. In areas where mast production is favorable, the squirrel population is good. Hunting pressure on this animal has been declining. A small resident population of woodcock inhabits areas on bottom land, and migratory flights of this species into Hickory County are minor.

The furbearer population is good throughout the county. Trapping pressure is strong, although it has

been reduced by a decline in fur prices. The most common fur species are raccoon, opossum, coyote, muskrat, red fox, gray fox, beaver, and mink. The bobcat population is fair. Seven cougar sightings have been recorded in recent years.

The primary prairie areas in Hickory County are in the Eldon-Creldon and Hartwell-Eldon-Barden associations. Limited numbers of prairie species inhabit the remaining native grassland that meets their strict habitat requirements. These species include prairie chicken, upland plover, marsh hawk, and badger.

The Hartwell-Eldon-Barden association provides the primary habitat for the openland wildlife in the county. The important grain crops are grain sorghum, soybeans, winter wheat, and corn. They are grown on a limited acreage. Nearly half of the cropland is plowed in the fall. Fall plowing is harmful to wildlife. Chisel plowing in the fall or other conservation tillage systems that leave more grain and a protective cover of crop residue on the surface after harvesting provide additional winter food and a limited amount of cover for wildlife. The population of bobwhite quail is poor. It fluctuates as a result of severe winter conditions. The rabbit population is only fair. Hunting pressure on this small game species is light. A fair population of mourning doves inhabits areas near harvested grain fields. Small migratory flights tend to keep hunting pressure on this game bird light.

The county has nearly no wetland habitat. The only remaining permanent wetlands are the mudflats and sloughs along the Pomme de Terre River and adjacent to the Truman Reservoir in Benton County and the areas along the southern drainageways of Pomme de Terre Lake. Both the Truman and Pomme de Terre Reservoirs provide some public wetland areas, but unpredictable water levels reduce the quality of the wetland vegetation. Ducks and geese use both reservoirs for migratory roosting. Small populations of waterfowl inhabit creek drainageways and open water areas. The extent of the habitat for wood duck has increased as a result of the Truman Reservoir. The waterfowl population is moderate throughout the county. It has generated short-term hunter interest. Conservation officials think that Truman Lake has had a positive effect on the wetland wildlife species.

Opportunities for fishing are provided by Truman Lake and Pomme de Terre Lake, rivers and creeks, and farm ponds. The rivers and streams are inhabited primarily by largemouth bass, channel catfish, bullheads, suckers, bluegill, and other sunfish. Truman Lake and Pomme de Terre Lake provide opportunities for impoundment fishing. The most popular species in Truman Lake include striped bass, white bass, walleye, largemouth bass, channel catfish, flathead catfish, paddlefish, and sunfish. Pomme de Terre Lake has fish species similar to those in Truman Lake, but it is not inhabited by striped bass and it is inhabited by muskellunge.

The farm ponds and small impoundments in the county have been stocked with largemouth bass, channel catfish, and bluegill. They provide many fishing opportunities for the landowner and invited guests.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the county are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface

stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, winter wheat, oats, and soybeans.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wheatgrass, and grama.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian olive, autumn olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, ruffed grouse, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

Soil properties, site features, and observed

performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreation uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary.

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and the depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. A high water table, depth to bedrock or to a cemented pan, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills generally are limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth.

Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 12 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. Slope and bedrock can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported

to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, reaction, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation

of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils generally is preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features generally are favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard

of soil blowing or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock affect the construction of grassed waterways. A hazard of soil blowing, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the county, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

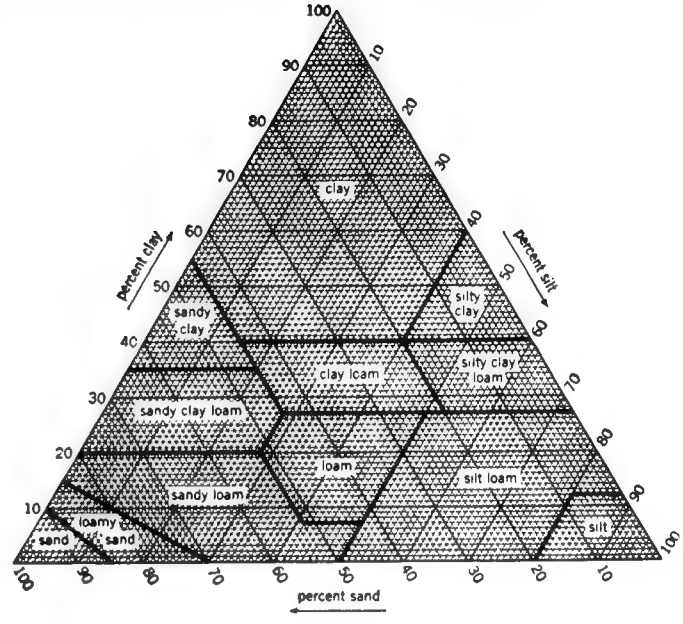

Figure 14.—Percentages of clay, silt, and sand in the basic USDA soil textural classes.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the county. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter (fig. 14). "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as about 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering

properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the county and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the county or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index generally are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the county. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH

of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic groups in table 17, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary inundation of an area, is caused by overflowing streams or by runoff from adjacent slopes. Water standing for short periods after rainfall or snowmelt is not considered flooding, nor is water in swamps and marshes.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that

flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs, on the average, once or less in 2 years; and *frequent* that it occurs, on the average, more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17. Only saturated zones within a depth of about 6 feet are indicated.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage mainly to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(9)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. Table 18 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalf (*Ud*, meaning humid, plus *alf*, from Alfisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalf*, the suborder of the Alfisols that has a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is very fine, mixed, mesic Typic Hapludalfs.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the *Soil Survey Manual (7)*. Many of the technical terms used in the descriptions are defined in *Soil Taxonomy (9)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Ashton Series

The Ashton series consists of deep, well drained, moderately permeable soils on high flood plains. These

soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Ashton silt loam, 2,830 feet east and 1,260 feet south of the northwest corner of sec. 15, T. 38 N., R. 23 W.

Ap—0 to 7 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak thin platy structure parting to weak fine granular; very friable; common worm casts; many fine roots; slightly acid; abrupt smooth boundary.

Bt1—7 to 14 inches; dark brown (7.5YR 3/4) silty clay loam; weak thin platy structure parting to weak fine subangular blocky; friable; common worm casts; common fine roots; few faint clay films on faces of peds; slightly acid; clear smooth boundary.

Bt2—14 to 23 inches; dark brown (7.5YR 3/4) silty clay loam; weak fine subangular blocky structure; friable; common fine roots; common distinct clay films on faces of peds; common silt coatings on faces of peds; slightly acid; clear smooth boundary.

Bt3—23 to 44 inches; dark brown (7.5YR 3/4) silty clay loam; weak fine subangular blocky structure; friable; common worm casts; few fine roots; common prominent clay films on faces of peds; common silt coatings on faces of peds; slightly acid; clear smooth boundary.

Bt4—44 to 60 inches; dark brown (7.5YR 3/4) silty clay loam; weak medium prismatic structure parting to weak fine subangular blocky; friable; few worm casts; few fine roots; common prominent clay films on faces of peds; few silt coatings on faces of peds; slightly acid.

The content of pebbles is 0 to 5 percent in the solum. The A horizon has hue of 10YR or 7.5YR and chroma of 2 or 3. The Bt horizon has hue of 7.5YR or 5YR, value of 3 to 5, and chroma of 3 to 6. It is silt loam or silty clay loam.

Barco Series

The Barco series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in acid sandstone residuum. Slopes range from 2 to 5 percent.

Typical pedon of Barco sandy loam, 2 to 5 percent slopes, 1,220 feet south and 100 feet west of the center of sec. 22, T. 36 N., R. 24 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; common medium roots; about 3 percent fine soft sandstone fragments; neutral; abrupt smooth boundary.

A—7 to 12 inches; very dark grayish brown (10YR 3/2) sandy loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; few fine roots; about 5 percent fine soft sandstone fragments; neutral; abrupt smooth boundary.

BA—12 to 15 inches; dark brown (10YR 4/3) clay loam; weak fine subangular blocky structure; very friable; few fine roots; common worm casts; about 10 percent fine sandstone fragments; slightly acid; clear smooth boundary.

Bt1—15 to 21 inches; mixed yellowish brown (10YR 5/6) and dark yellowish brown (10YR 4/4) clay loam; weak fine subangular blocky structure; friable; few fine roots; common distinct clay films on faces of peds; about 5 percent fine sandstone fragments; slightly acid; clear smooth boundary.

Bt2—21 to 27 inches; mixed yellowish red (5YR 5/8) and yellowish brown (10YR 5/4) clay loam; weak fine subangular blocky structure; friable; few fine roots; common distinct clay bridges; about 10 percent soft sandstone fragments; strongly acid; gradual wavy boundary.

Cr1—27 to 36 inches; soft, broken sandstone that has clay loam in cracks; few fine roots.

Cr2—36 to 60 inches; soft sandstone.

The depth to soft sandstone ranges from 20 to 40 inches. The A horizon has hue of 7.5YR or 10YR and value and chroma of 2 or 3. The Bt horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 3 to 8. It is loam, sandy clay loam, or clay loam.

Barden Series

The Barden series consists of deep, moderately well drained, slowly permeable soils on uplands. These soils formed in loess or silty material and in shale residuum. Slopes range from 2 to 5 percent.

Typical pedon of Barden silt loam, 2 to 5 percent slopes, 2,590 feet east and 100 feet north of the southwest corner of sec. 15, T. 36 N., R. 24 W.

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; many fine roots; neutral; abrupt smooth boundary.

BA—7 to 12 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; many fine roots; few fine and very fine dark concretions of

iron and manganese oxide; slightly acid; clear smooth boundary.

Bt1—12 to 23 inches; dark brown (10YR 4/3) silty clay; many fine faint grayish brown (10YR 5/2) and many fine distinct dark brown (7.5YR 4/4) mottles; moderate fine subangular blocky structure; very firm; common fine roots; common prominent clay films on faces of peds; few fine concretions of iron and manganese oxide; slightly acid; clear smooth boundary.

Bt2—23 to 39 inches; light brownish gray (10YR 6/2) silty clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; weak fine subangular blocky structure; firm; few fine roots; common prominent clay films on faces of peds; medium acid; gradual smooth boundary.

C—39 to 60 inches; yellowish brown (10YR 5/6) silty clay loam; many coarse prominent gray (10YR 6/2) mottles; weak fine subangular blocky structure; firm; few fine roots; common prominent clay films; about 8 percent chert fragments smaller than 3 inches; slightly acid.

The A horizon has value of 2 or 3 and chroma of 1 to 3. The BA horizon has value of 3 or 4 and chroma of 2 to 4. The Bt horizon has value of 4 to 6 and chroma of 2 to 6. The C horizon is silty clay loam or clay loam.

Bardley Series

The Bardley series consists of moderately deep, well drained, moderately permeable soils on uplands. These soils formed in cherty sediments and clayey material or dolomite residuum interbedded with limestone and sandstone. Slopes range from 3 to 50 percent.

Typical pedon of Bardley very cherty silt loam, 3 to 9 percent slopes, 200 feet south and 2,380 feet east of the northwest corner of sec. 30, T. 38 N., R. 22 W.

A—0 to 5 inches; dark brown (10YR 3/3) very cherty silt loam, brown (10YR 5/3) dry; weak fine granular structure; very friable; many fine and few medium roots; about 40 percent chert fragments; slightly acid; clear smooth boundary.

E—5 to 14 inches; dark yellowish brown (10YR 4/4) very cherty silt loam; weak fine granular structure; very friable; many fine and few medium roots; about 60 percent chert fragments; slightly acid; clear wavy boundary.

2Bt1—14 to 21 inches; red (2.5YR 4/6) cherty clay; weak fine subangular blocky structure; very firm; few fine roots; many prominent clay films on faces of peds; common fine manganese stains; about 30 percent chert fragments; medium acid; clear wavy boundary.

2Bt2—21 to 27 inches; strong brown (7.5YR 5/6) clay; weak fine subangular blocky structure; very firm; few fine roots; many prominent clay films on faces of peds; common fine manganese stains; about 8 percent chert fragments; slightly acid; abrupt smooth boundary.

2R1—27 to 38 inches; hard dolomite; strongly effervescent.

2R2—38 inches; hard dolomite.

The depth to bedrock ranges from 20 to 40 inches. The A horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. The 2Bt horizon has hue of 10R, 2.5YR, or 5YR, value of 3 to 5, and chroma of 4 to 6.

Claiborne Series

The Claiborne series consists of deep, well drained, moderately permeable soils on foot slopes and upland side slopes along stream valleys. These soils formed in local colluvium or cherty limestone residuum. Slopes range from 5 to 9 percent.

Typical pedon of Claiborne silt loam, 5 to 9 percent slopes, 1,450 feet north and 250 feet west of the southeast corner of sec. 23, T. 37 N., R. 22 W.

Ap—0 to 6 inches; dark yellowish brown (10YR 3/4) silt loam, yellowish brown (10YR 5/4) dry; weak fine granular structure; very friable; few fine roots; few worm casts; very strongly acid; abrupt smooth boundary.

BA—6 to 10 inches; dark brown (7.5YR 4/4) silt loam; weak fine subangular blocky structure; very friable; few fine roots; few worm casts; strongly acid; clear smooth boundary.

Bt1—10 to 16 inches; yellowish red (5YR 4/6) silty clay loam; weak fine subangular blocky structure; friable; few worm casts; common faint clay films on faces of peds; strongly acid; clear smooth boundary.

Bt2—16 to 32 inches; yellowish red (5YR 4/6) silty clay loam; weak fine subangular blocky structure; friable; few fine roots; common prominent clay films on faces of peds; about 8 percent chert fragments smaller than 1 inch; few black stains; very strongly acid; clear smooth boundary.

Bt3—32 to 50 inches; red (2.5YR 4/6) silty clay loam; weak fine subangular blocky structure; friable; common prominent clay films on faces of peds;

about 8 percent chert fragments smaller than 1 inch; few black stains; very strongly acid; clear smooth boundary.

Bt4—50 to 60 inches; red (2.5YR 4/6) silty clay loam; weak fine subangular blocky structure; friable; few prominent clay films; very strongly acid.

The content of angular chert fragments ranges from 0 to 25 percent. The A horizon has chroma of 3 or 4. The Bt horizon has hue of 7.5YR, 5YR, or 2.5YR, value of 3 to 5, and chroma of 4 to 8. It is dominantly silty clay loam, but in some pedons the lower part is clay.

Creldon Series

The Creldon series consists of deep, moderately well drained soils in the uplands. These soils formed in loess or other loamy material and in the underlying cherty limestone residuum. They have a fragipan. Permeability is moderately slow above the fragipan and very slow in the fragipan. Slopes range from 2 to 5 percent.

Typical pedon of Creldon silt loam, 2 to 5 percent slopes, 2,310 feet west and 324 feet south of the northeast corner of sec. 12, T. 36 N., R. 23 W.

A—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; many fine roots; slightly acid; clear smooth boundary.

Bt1—9 to 14 inches; dark brown (10YR 4/3) silty clay loam; weak fine subangular blocky structure; friable; many fine roots; few distinct clay films on faces of peds; few fine concretions of iron and manganese oxide; slightly acid; clear smooth boundary.

Bt2—14 to 22 inches; dark brown (10YR 4/3) silty clay loam; many fine prominent red (2.5YR 4/8) mottles; weak fine subangular blocky structure; friable; common fine roots; common prominent clay films on faces of peds; few fine concretions of iron and manganese oxide; about 5 percent chert fragments smaller than 3 inches; slightly acid; clear wavy boundary.

Bt3—22 to 30 inches; dark brown (10YR 4/3) silty clay loam; common medium faint grayish brown (10YR 5/2) and common medium prominent red (2.5YR 4/8) mottles; weak fine subangular blocky structure; firm; few fine roots; many prominent clay films on faces of peds; few fine black concretions of iron and manganese oxide; about 10 percent chert fragments smaller than 3 inches; slightly acid; abrupt wavy boundary.

2Btx—30 to 41 inches; dark grayish brown (10YR 4/2) silty clay loam; many coarse faint gray (10YR 5/1) and few fine prominent red (2.5YR 4/6) mottles; moderate fine subangular blocky structure; very firm; brittle; many prominent clay films on faces of peds; about 10 percent chert fragments smaller than 3 inches; medium acid; abrupt smooth boundary.

2Bt1—41 to 46 inches; dark yellowish brown (10YR 4/4) cherty silty clay; many coarse distinct gray (10YR 5/1) and many medium prominent red (2.5YR 4/8) mottles; weak fine subangular blocky structure; very firm; many prominent clay films on faces of peds; about 25 percent chert fragments smaller than 3 inches, 5 percent larger than 3 inches; medium acid; clear irregular boundary.

2Bt2—46 to 60 inches; dark yellowish brown (10YR 4/4) very cherty clay; many coarse distinct gray (10YR 5/1) and many medium prominent red (2.5YR 4/8) mottles; weak fine subangular blocky structure; very firm; many prominent clay films on faces of peds; about 40 percent chert fragments smaller than 3 inches, 5 percent larger than 3 inches; medium acid.

Depth to the fragipan is 18 to 36 inches. The content of chert commonly is 0 to 5 percent in the A and Bt horizons but ranges to 10 percent directly above the fragipan. It ranges from 10 to 60 percent in and below the fragipan.

The A horizon has hue of 10YR or 7.5YR and value and chroma of 2 or 3. The Bt horizon has hue of 10YR to 5YR, value of 3 to 5, and chroma of 2 to 6. It is silty clay loam or silty clay. The 2Btx horizon has hue of 10YR to 5YR, value of 4 to 6, and chroma of 3 to 6. The 2Bt horizon is the cherty, very cherty, or extremely cherty analogs of clay or silty clay.

Eldon Series

The Eldon series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in limestone residuum interbedded with shale and sandstone. Slopes range from 3 to 14 percent.

Typical pedon of Eldon cherty silt loam, 3 to 9 percent slopes, 1,920 feet west and 150 feet north of the southeast corner of sec. 14, T. 38 N., R. 21 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) cherty silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; very friable; many fine roots; about 18 percent chert fragments 0.5 to 1.0 inch in size; about 0.5 percent of the surface covered with chert fragments 3 to 10 inches

in size; medium acid; abrupt smooth boundary.
A—6 to 10 inches; dark brown (10YR 3/3) cherty silt loam, brown (10YR 5/3) dry; weak fine granular structure; very friable; many fine roots; about 18 percent chert fragments smaller than 3 inches; medium acid; clear wavy boundary.
Bt1—10 to 19 inches; dark yellowish brown (10YR 4/4) very cherty silty clay loam; many fine prominent yellowish red (5YR 4/6) mottles; weak fine subangular blocky structure; friable; common fine roots; few faint clay films; about 5 percent chert fragments larger than 3 inches, 40 percent smaller than 3 inches; strongly acid; abrupt smooth boundary.
Bt2—19 to 24 inches; yellowish red (5YR 4/6) extremely cherty silty clay loam; many fine prominent yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; firm; few fine roots; many prominent clay films; about 70 percent chert fragments smaller than 3 inches; strongly acid; clear smooth boundary.
2Bt3—24 to 37 inches; red (2.5YR 4/6) cherty silty clay; many very pale brown (10YR 7/3) silt coatings; moderate fine angular blocky structure; firm; few fine roots; many prominent clay films; about 18 percent chert fragments smaller than 1 inch; strongly acid; clear smooth boundary.
2Bt4—37 to 60 inches; red (2.5YR 4/6) cherty clay; moderate fine angular blocky structure; very firm; few fine roots; many prominent slickensides; about 18 percent chert fragments smaller than 1 inch; medium acid.

The content of coarse fragments ranges from 8 to 40 percent in the A horizon and from 18 to 85 percent in the Bt horizon. The content of chert averages more than 35 percent in the upper 20 inches of the argillic horizon.

The A horizon has hue of 10YR or 7.5YR and value of 2 or 3. The Bt horizon has hue of 2.5YR to 10YR, value of 3 or 4, and chroma of 3 to 6. It is clay, silty clay, silty clay loam, or the cherty and very cherty analogs of those textures. The content of clay ranges from 35 to 50 percent in the upper 20 inches of the argillic horizon.

Gasconade Series

The Gasconade series consists of shallow, somewhat excessively drained soils on uplands. These soils formed in limestone residuum. Permeability is moderately slow. Slopes range from 3 to 50 percent.

Typical pedon of Gasconade flaggy silty clay loam, in an area of Gasconade-Rock outcrop complex, 3 to 9 percent slopes; 2,370 feet north and 1,900 feet west of the southeast corner of sec. 7, T. 36 N., R. 22 W.

A—0 to 5 inches; very dark brown (10YR 2/2) flaggy silty clay loam, dark grayish brown (10YR 4/2) dry; moderate fine granular structure; firm; many fine and medium roots; about 20 percent limestone fragments 6 to 15 inches in size; about 8 percent chert fragments smaller than 3 inches; slightly acid; abrupt wavy boundary.
Bw—5 to 13 inches; very dark brown (10YR 2/2) very flaggy silty clay loam, very dark grayish brown (10YR 3/2) dry; strong fine subangular blocky structure; very firm; many medium and few coarse roots; about 55 percent limestone fragments 6 to 15 inches in size; neutral; abrupt wavy boundary.
R—13 inches; hard limestone.

The depth to limestone bedrock ranges from about 4 to 20 inches. The A horizon has value of 2 or 3 and chroma of 1 or 2. The Bw horizon has hue of 7.5YR to 2.5Y and value and chroma of 2 to 4. It is the very flaggy analogs of silty clay loam, silty clay, clay, or clay loam.

Gepp Series

The Gepp series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in cherty dolomite or cherty limestone residuum. Slopes range from 3 to 9 percent.

Typical pedon of Gepp very cherty silt loam, 3 to 9 percent slopes, 1,445 feet south and 1,690 feet west of the northeast corner of sec. 30, T. 38 N., R. 23 W.

A—0 to 5 inches; dark grayish brown (10YR 4/2) very cherty silt loam, light brownish gray (10YR 6/2) dry; weak fine granular structure; very friable; many fine and medium roots; about 30 percent chert fragments larger than 3 inches, 10 percent smaller than 3 inches; strongly acid; abrupt smooth boundary.
E—5 to 13 inches; pale brown (10YR 6/3) very cherty silt loam; weak fine granular structure; very friable; many fine and few coarse roots; about 20 percent chert fragments larger than 3 inches, 20 percent smaller than 3 inches; very strongly acid; clear wavy boundary.
2Bt1—13 to 33 inches; yellowish red (5YR 5/6) cherty clay; common fine prominent red (2.5YR 4/8) and few fine prominent light yellowish brown (10YR 6/4) mottles; moderate fine subangular blocky structure;

very firm; many fine and few medium roots; many prominent clay films; about 5 percent chert fragments larger than 3 inches, 15 percent smaller than 3 inches; strongly acid; gradual wavy boundary.

2Bt2—33 to 45 inches; red (2.5YR 4/8) clay; common coarse prominent strong brown (7.5YR 5/8) and few coarse prominent pale brown (10YR 6/3) mottles; moderate fine subangular blocky structure; very firm; few fine and medium roots; few slickensides; many prominent clay films; about 5 percent chert fragments smaller than 3 inches; strongly acid; gradual wavy boundary.

2Bt3—45 to 70 inches; red (2.5YR 4/6) clay; many medium and coarse prominent brownish yellow (10YR 6/6) and light brownish gray (10YR 6/2) mottles; moderate fine subangular blocky structure; very firm; few fine roots; common slickensides; few iron stains on faces of peds; slightly acid.

The content of chert fragments ranges from 15 to 60 percent in the A horizon and from 0 to 35 percent in the Bt horizon. The A horizon has value of 3 to 5 and chroma of 2 to 4. It is the cherty or very cherty analogs of loam or silt loam. The Bt horizon has hue of 2.5YR to 7.5YR, value of 3 to 5, and chroma of 4 to 8. The content of clay ranges from 48 to 70 percent in the upper 20 inches of the argillic horizon.

Goss Series

The Goss series consists of deep, well drained, moderately permeable soils on uplands. These soils formed in cherty limestone or cherty dolomite residuum. Slopes range from 14 to 45 percent.

Typical pedon of Goss very cherty silt loam, 14 to 45 percent slopes, 1,850 feet west and 2,050 feet south of the northeast corner of sec. 3, T. 37 N., R. 20 W.

A—0 to 2 inches; very dark grayish brown (10YR 3/2) very cherty silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; many fine roots; about 25 percent chert fragments smaller than 3 inches, 15 percent larger than 3 inches; strongly acid; abrupt smooth boundary.

E—2 to 12 inches; yellowish brown (10YR 5/4) very cherty silt loam; weak fine granular structure; very friable; many fine and common medium roots; about 10 percent chert fragments larger than 3 inches, 10 percent 1 to 3 inches, and 20 percent smaller than 1 inch; very strongly acid; clear wavy boundary.

BE—12 to 22 inches; yellowish brown (10YR 5/4) very cherty silty clay loam; few yellowish red (5YR 4/6) streaks; weak fine subangular blocky structure; friable; common medium roots; few distinct clay films on faces of peds; about 10 percent chert fragments larger than 3 inches, 10 percent 1 to 3 inches, and 30 percent less than 1 inch; very strongly acid; clear wavy boundary.

Bt1—22 to 34 inches; red (10R 4/6) very cherty clay; weak fine subangular blocky structure; very firm; few fine roots; common prominent clay films on faces of peds; about 7 percent chert fragments larger than 3 inches, 15 percent 1 to 3 inches, and 18 percent less than 1 inch; strongly acid; clear wavy boundary.

Bt2—34 to 44 inches; red (10R 4/8) very cherty clay; weak fine subangular blocky structure; very firm; few fine roots; common prominent clay films; about 15 percent chert fragments larger than 3 inches, 25 percent 1 to 3 inches, and 20 percent less than 1 inch; strongly acid; abrupt smooth boundary.

Bt3—44 to 60 inches; red (10R 4/8) clay; brown (10YR 5/3) streaks; weak fine subangular blocky structure; very firm; few fine roots in the brown streaks; about 8 percent sandstone fragments 1 inch or less in size; strongly acid.

The A horizon has value and chroma of 2 to 4. It typically is very cherty silt loam, but the range includes silt loam and cherty silt loam. The E horizon has value of 5 or 6 and chroma of 3 or 4. The content of coarse fragments ranges from 15 to 80 percent in this horizon. The Bt horizon has hue of 10R to 7.5YR, value of dominantly 4 or 5, and chroma of 4 to 8. In some pedons it has value of 3 in the lower part. It is silty clay, clay, or the cherty to extremely cherty analogs of silty clay loam, silty clay, or clay.

Hartwell Series

The Hartwell series consists of deep, somewhat poorly drained, slowly permeable soils on broad upland ridgetops. These soils formed in loess and shale residuum. Slopes range from 0 to 3 percent.

Typical pedon of Hartwell silt loam, 0 to 2 percent slopes, 850 feet north and 110 feet east of the southwest corner of sec. 21, T. 37 N., R. 23 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; many fine roots; few fine concretions; medium acid; abrupt smooth boundary.

E—6 to 10 inches; grayish brown (10YR 5/2) silt loam; weak thin platy structure parting to weak fine

granular; very friable; many fine roots; few fine concretions of iron and manganese oxide; medium acid; abrupt smooth boundary.

Bt1—10 to 20 inches; very dark grayish brown (10YR 3/2) clay, dark grayish brown (10YR 4/2) dry; many medium prominent dark red (2.5YR 3/6) mottles; moderate fine subangular blocky structure; very firm; many fine roots; many prominent clay films; few fine concretions of iron and manganese oxide; strongly acid; abrupt smooth boundary.

Bt2—20 to 34 inches; grayish brown (10YR 5/2) silty clay; common fine prominent yellowish brown (10YR 5/6) mottles; moderate fine subangular blocky structure; very firm; many fine roots; common prominent clay films; few fine concretions of iron and manganese oxide; strongly acid; abrupt smooth boundary.

C1—34 to 48 inches; gray (10YR 6/1) silty clay loam; many medium prominent brownish yellow (10YR 6/6) mottles; weak medium subangular blocky structure; firm; few fine roots; common prominent clay films; few fine concretions of iron and manganese oxide; strongly acid; clear smooth boundary.

C2—48 to 60 inches; gray (10YR 6/1) silty clay loam; many coarse prominent light yellowish brown (10YR 6/4) and dark brown (7.5YR 4/4) mottles; massive; firm; many fine roots; few prominent clay films in root pores; few fine concretions of iron and manganese oxide; about 5 percent gravel; strongly acid.

The A horizon has value of 2 or 3 and chroma of 1 or 2. The E horizon has value of 5 or 6 and chroma of 1 or 2. The upper part of the Bt horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 or 2. It is clay or silty clay. The lower part has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 2 to 8. It is silty clay loam or silty clay.

Knobby Series

The Knobby series consists of very shallow, well drained, moderately permeable soils on dissected uplands. These soils formed in arenaceous dolomite residuum. Slopes range from 3 to 50 percent.

Typical pedon of Knobby very cobbly loam, in an area of Knobby-Rock outcrop complex, 9 to 50 percent slopes; 1,700 feet west and 1,750 feet south of the northeast corner of sec. 18, T. 38 N., R. 20 W.

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) very cobbly loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; common fine roots; about 18 percent chert and dolomite fragments 1 to 3 inches in size, 25 percent 3 to 10 inches; neutral; clear wavy boundary.

A2—5 to 9 inches; very dark grayish brown (10YR 3/2) very cobbly loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; common fine roots; about 25 percent chert and dolomite fragments 1 to 3 inches in size, 25 percent 3 to 10 inches; mildly alkaline; abrupt smooth boundary.

R—9 inches; sandy dolomite.

The depth to bedrock ranges from 4 to 10 inches. The content of clay ranges from 10 to 18 percent in the fine-earth fraction. The A horizon has value of 2 or 3 and chroma of 1 or 2.

Lebanon Series

The Lebanon series consists of deep, moderately well drained soils on uplands. These soils formed in loess and in the underlying cherty limestone residuum. They have a fragipan. Permeability is moderately slow above the fragipan and very slow in the fragipan. Slopes range from 2 to 9 percent.

Typical pedon of Lebanon silt loam, 2 to 5 percent slopes, 2,580 feet west and 50 feet north of the southeast corner of sec. 7, T. 38 N., R. 20 W.

Ap—0 to 6 inches; yellowish brown (10YR 5/4) silt loam; weak fine granular structure; very friable; many medium and fine roots; few fine concretions of iron and manganese oxide; medium acid; clear smooth boundary.

Bt1—6 to 9 inches; yellowish brown (10YR 5/6) silty clay loam; many medium prominent pale brown (10YR 6/3) mottles; weak fine subangular blocky structure; friable; many medium and fine roots; few faint clay films on faces of peds; few fine concretions of iron and manganese oxide; strongly acid; clear smooth boundary.

Bt2—9 to 17 inches; strong brown (7.5YR 4/6) silty clay loam; weak fine subangular blocky structure; firm; many medium and few coarse roots; few faint clay films on faces of peds; few fine concretions of iron and manganese oxide; strongly acid; clear smooth boundary.

Bt3—17 to 24 inches; yellowish brown (10YR 5/4) silty clay; few fine distinct light brownish gray (10YR 6/2) and many medium prominent strong brown (7.5YR 4/6) mottles; weak fine subangular blocky structure; very firm; common coarse roots; many prominent clay films; few fine concretions of iron and

manganese oxide; about 8 percent chert fragments smaller than 3 inches; very strongly acid; gradual smooth boundary.

2Ex—24 to 29 inches; light brownish gray (10YR 6/2) silty clay loam; many fine distinct yellowish brown (10YR 5/4) mottles; weak thin platy structure parting to weak fine subangular blocky; very firm; brittle; common medium roots; few fine chert fragments; very strongly acid; gradual wavy boundary.

2Bx1—29 to 33 inches; light brownish gray (10YR 6/2) silty clay loam; many fine distinct yellowish brown (10YR 5/4) mottles; weak thin platy structure parting to weak fine subangular blocky; very firm; brittle; very few fine roots; few chert fragments; very strongly acid; abrupt smooth boundary.

2Bx2—33 to 43 inches; brown (10YR 5/3) cherty silty clay loam; weak medium platy structure parting to moderate fine subangular blocky; very firm; brittle; about 20 percent chert fragments; very strongly acid; abrupt irregular boundary.

2Bt—43 to 60 inches; red (2.5YR 4/6) cherty silty clay; weak fine subangular blocky structure; firm; pale brown (10YR 6/3) silt coatings on faces of peds; about 20 percent chert fragments; very strongly acid.

Depth to the fragipan ranges from 18 to 24 inches. The A horizon has value of 4 or 5 and chroma of 3 or 4. Some pedons have an E horizon. This horizon has value of 4 to 6 and chroma of 2 to 4. The Bt horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 4 to 6. The 2Ex and 2Bx horizons have value of 4 to 6 and chroma of 2 or 3. They are silt loam, silty clay loam, or the cherty analogs of those textures. The 2Bt horizon has hue of 2.5YR or 5YR, value of 3 to 5, and chroma of 4 to 6. It is silty clay, clay, or the cherty analogs of those textures.

McGirk Series

The McGirk series consists of deep, poorly drained, slowly permeable soils on the lower side slopes and on foot slopes in the uplands. These soils formed in local colluvium and alluvium. Slopes range from 2 to 5 percent.

Typical pedon of McGirk silt loam, 2 to 5 percent slopes, 2,425 feet south and 1,305 feet east of the northwest corner of sec. 29, T. 38 N., R. 23 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam, brown (10YR 5/3) dry; weak fine granular structure; very friable; many fine roots; few fine concretions of iron and manganese oxide; strongly acid; abrupt smooth boundary.

BE—5 to 9 inches; grayish brown (10YR 5/2) silty clay loam; weak fine subangular blocky structure; friable; many fine roots; common faint clay films; common silt coatings in root channels; few fine concretions of iron and manganese oxide; very strongly acid; abrupt smooth boundary.

Btg1—9 to 13 inches; grayish brown (10YR 5/2) silty clay; common fine prominent reddish brown (5YR 4/4) mottles; weak fine subangular blocky structure; firm; common fine roots; many prominent clay films; few fine concretions of iron and manganese oxide; few fine chert fragments; very strongly acid; clear smooth boundary.

Btg2—13 to 23 inches; dark gray (10YR 4/1) silty clay; many medium distinct dark yellowish brown (10YR 4/4) and few fine faint light brownish gray (10YR 6/2) mottles; moderate fine subangular blocky structure; very firm; common fine roots; many prominent clay films; few fine concretions of iron and manganese oxide; very strongly acid; gradual wavy boundary.

Btg3—23 to 46 inches; mottled light brownish gray (10YR 6/2), yellowish brown (10YR 5/4), and dark yellowish brown (10YR 4/6) silty clay loam; moderate fine subangular blocky structure; firm; few fine roots; common clay films in root channels; few fine concretions of iron and manganese oxide; few chert fragments; black stains on faces of peds; very strongly acid; clear wavy boundary.

Cg—46 to 60 inches; mottled light gray (10YR 6/1), yellowish brown (10YR 5/4), and dark yellowish brown (10YR 4/6) silty clay loam; massive; firm; few fine roots; common clay films in root channels; few chert fragments; medium acid.

The Ap horizon has value of 4 or 5 and chroma of 2 or 3. Some pedons have an E horizon. This horizon has value of 6 or 7. The Btg horizon has hue of 10YR or 2.5Y and value of 4 to 6. The Cg horizon is silty clay loam or silt loam.

Moniteau Series

The Moniteau series consists of deep, poorly drained, moderately slowly permeable soils on high flood plains. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Moniteau silt loam, 200 feet south and 450 feet east of the northwest corner of sec. 18, T. 38 N., R. 23 W.

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam, light brownish gray (10YR 6/2) dry; weak thin platy structure parting to weak fine granular; very friable; many fine roots; common fine concretions; neutral; abrupt smooth boundary.

E—7 to 14 inches; mixed light brownish gray (10YR 6/2) and light gray (10YR 7/1) silt loam; weak thin platy structure parting to weak fine granular; very friable; common fine roots; common root pores; common fine concretions; slightly acid; clear smooth boundary.

Btg1—14 to 25 inches; grayish brown (10YR 5/2) silt loam; few fine distinct dark yellowish brown (10YR 4/4) mottles; weak fine subangular blocky structure; very friable; few fine roots; many root pores; few faint clay films; few fine concretions; medium acid; gradual smooth boundary.

Btg2—25 to 46 inches; light brownish gray (10YR 6/2) silty clay loam; many fine distinct light yellowish brown (10YR 6/4) mottles; weak fine subangular blocky structure; friable; few very fine roots; common root pores; common faint and few distinct clay films; few fine concretions; medium acid; gradual smooth boundary.

Btg3—46 to 70 inches; mottled light gray (10YR 6/1) and dark brown (7.5YR 4/4) silty clay loam; weak fine subangular blocky structure; friable; few very fine roots; few prominent clay films; few fine concretions; medium acid.

The A or Ap horizon has value of 4 or 5 and chroma of 1 or 2. The E horizon has value of 4 to 7 and chroma of 1 or 2. The Bt horizon has hue of 10YR to 5Y, value of 4 to 6, and chroma of 1 or 2.

Plato Series

The Plato series consists of deep, somewhat poorly drained soils on uplands. These soils formed in a thin mantle of loess and in the underlying clayey material weathered from cherty limestone or dolomite. They have a fragipan. Permeability is moderately slow above the fragipan and very slow in the fragipan. Slopes range from 1 to 3 percent.

Typical pedon of Plato silt loam, 1 to 3 percent slopes, 2,550 feet east and 1,100 feet south of the northwest corner of sec. 31, T. 36 N., R. 21 W.

Ap—0 to 6 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; weak fine granular structure; very friable; many fine roots; common fine concretions of iron and manganese oxide; few fine chert fragments; slightly acid; abrupt smooth boundary.

E—6 to 11 inches; pale brown (10YR 6/3) silt loam; many medium faint light gray (10YR 7/2) mottles; weak fine granular structure; very friable; common fine roots; common fine concretions of iron and manganese oxide; few fine chert fragments; strongly acid; clear smooth boundary.

Bt—11 to 14 inches; light yellowish brown (10YR 6/4) silty clay loam; common medium distinct dark yellowish brown (10YR 4/6) mottles; weak fine subangular blocky structure; friable; few fine roots; few distinct clay films on faces of peds; few fine concretions of iron and manganese oxide; strongly acid; abrupt smooth boundary.

Btg1—14 to 17 inches; grayish brown (10YR 5/2) silty clay loam; few fine prominent dark yellowish brown (10YR 4/6) mottles; moderate fine subangular blocky structure; firm; few fine roots; many gray silt coatings in root channels and on faces of peds; common fine concretions of iron and manganese oxide; very strongly acid; abrupt irregular boundary.

Btg2—17 to 26 inches; grayish brown (10YR 5/2) silty clay; few medium prominent yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate fine subangular blocky; very firm; few fine roots; few slickensides; many prominent clay films; common fine concretions of iron and manganese oxide; gray silt coatings in root channels; very strongly acid; abrupt irregular boundary.

2Btx1—26 to 32 inches; mixed brownish yellow (10YR 6/6) and strong brown (7.5YR 4/6) silty clay loam; common fine distinct dark yellowish brown (10YR 3/6) and common fine prominent light gray (10YR 6/1) mottles; moderate medium subangular blocky structure; very firm; brittle; few fine roots in polygons; many prominent clay films on faces of peds; common fine concretions of iron and manganese oxide; few fine chert fragments; very strongly acid; abrupt irregular boundary.

2Btx2—32 to 40 inches; mixed strong brown (7.5YR 5/6 and 4/6) and light gray (10YR 6/1) cherty silty clay loam; moderate medium subangular blocky structure; very firm; brittle; common prominent clay films; about 30 percent chert fragments smaller than 1 inch; very strongly acid; clear wavy boundary.

2Bt—40 to 60 inches; mixed strong brown (7.5YR 4/6) and dark red (2.5YR 3/6) cherty clay; light gray (10YR 6/1) coatings on faces of some peds; weak fine subangular blocky structure; very firm; common

prominent clay films; common slickensides; about 10 percent chert fragments larger than 3 inches, 20 percent smaller than 3 inches; very strongly acid.

Depth to the fragipan is 20 to 35 inches. The content of chert is less than 5 percent in the A horizon and in the upper part of the B horizon, 0 to 15 percent in the part of the Bt horizon above the fragipan, 5 to 40 percent in the fragipan, and 30 to 75 percent below the fragipan.

The Ap horizon has value of 5 or 6 and chroma of 2 or 3. The Bt horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 2 to 6. The 2Bt horizon has hue of 7.5YR to 2.5YR, value of 3 to 6, and chroma of 4 to 6.

Racket Series

The Racket series consists of deep, well drained, moderately permeable soils on flood plains along small streams. These soils formed in alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Racket silt loam, loamy substratum, 680 feet south and 1,340 feet west of the northeast corner of sec. 23, T. 37 N., R. 22 W.

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; common worm casts; neutral; clear smooth boundary.

A1—6 to 20 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; very friable; common worm casts; neutral; clear smooth boundary.

A2—20 to 28 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; very friable; many fine and few medium roots; many worm casts; few yellowish brown (10YR 5/4) pockets and lenses of sand; neutral; clear smooth boundary.

A3—28 to 36 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; very friable; common fine roots; many worm casts; neutral; clear smooth boundary.

A4—36 to 48 inches; dark brown (10YR 3/3) loam, brown (10YR 5/3) dry; weak medium platy structure parting to weak fine granular; very friable; few medium roots; many worm casts; thin strata of yellowish brown (10YR 5/4) sandy loam; neutral; clear smooth boundary.

C—48 to 60 inches; brown (10YR 4/3) loam, brown (10YR 5/3) dry; massive; very friable; few fine roots; few worm casts; thin strata of yellowish brown (10YR 5/4) very fine sandy loam; neutral.

The thickness of the mollic epipedon ranges from 24 to 40 inches. The A horizon has value and chroma of 2 or 3. In some pedons it has thin strata of gravelly material. The C horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6.

Sampsel Series

The Sampsel series consists of deep, poorly drained, slowly permeable soils on the upper side slopes and on foot slopes in the uplands. These soils formed in material weathered from calcareous shale and some limestone. Slopes range from 2 to 5 percent.

Typical pedon of Sampsel silty clay loam, 2 to 5 percent slopes, 1,300 feet east and 2,050 feet south of the northwest corner of sec. 3, T. 36 N., R. 23 N.

Ap—0 to 7 inches; very dark gray (10YR 3/1) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; few worm casts; many fine roots; few fine black concretions of iron and manganese oxide; slightly acid; abrupt smooth boundary.

A—7 to 10 inches; very dark gray (10YR 3/1) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; few worm casts; many fine roots; few fine black concretions of iron and manganese oxide; neutral; clear smooth boundary.

Btg1—10 to 17 inches; very dark gray (10YR 3/1) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; few worm casts; many fine roots; few distinct clay films on faces of peds; few fine concretions of iron and manganese oxide; neutral; clear smooth boundary.

Btg2—17 to 27 inches; dark gray (10YR 4/1) silty clay loam, gray (10YR 6/1) dry; weak medium prismatic structure parting to weak fine subangular blocky; firm; common fine roots; many distinct clay films on faces of peds; few fine concretions of iron and manganese oxide; neutral; gradual smooth boundary.

Btg3—27 to 46 inches; dark gray (10YR 4/1) silty clay loam; weak medium prismatic structure parting to weak fine subangular blocky; firm; common fine roots; few prominent clay films on faces of peds; few fine black concretions of iron and manganese oxide; neutral; gradual smooth boundary.

Btg4—46 to 70 inches; gray (10YR 5/1) silty clay loam;

common fine prominent yellowish brown (10YR 5/6) and few fine prominent dark grayish brown (2.5Y 4/2) mottles; weak coarse prismatic structure parting to weak coarse subangular blocky; firm; few fine roots; few prominent clay films on faces of peds; few fine concretions of iron and manganese oxide; neutral.

The A horizon has hue of 10YR or 2.5Y, value of 2 or 3, and chroma of 1 or 2. The Bt horizon has hue of 10YR to 5Y, value of 3 to 6, and chroma of 1 or 2. It is silty clay loam, silty clay, or clay.

Verdigris Series

The Verdigris series consists of deep, moderately well drained, moderately permeable soils on flood plains. These soils formed in silty alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Verdigris silt loam, 1,730 feet south and 1,000 feet east of the northwest corner of sec. 7, T. 38 N., R. 23 W.

Ap1—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; very friable; few worm casts; many fine roots; slightly acid; abrupt smooth boundary.

Ap2—6 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; very friable; few worm casts; many fine roots; slightly acid; abrupt smooth boundary.

A1—9 to 18 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure parting to weak fine granular; very friable; common worm casts; many fine roots; very dark gray (10YR 3/1) coatings on faces of peds; medium acid; gradual smooth boundary.

A2—18 to 35 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; many coarse and fine roots; medium acid; gradual smooth boundary.

A3—35 to 45 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; friable; common fine roots; medium acid; gradual smooth boundary.

2Ab1—45 to 57 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; many medium distinct dark yellowish brown (10YR 4/4) mottles; weak fine subangular blocky structure; friable; few fine roots; few fine concretions of iron and manganese oxide; slightly acid; gradual smooth boundary.

2Ab2—57 to 72 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; many medium distinct dark yellowish brown (10YR 3/4) mottles; weak fine subangular blocky structure; friable; few fine concretions of iron and manganese oxide; slightly acid.

The A horizon has hue of 7.5YR to 2.5Y, value of 2 or 3, and chroma of 1 to 3. The Ab horizon has hue of 7.5YR to 2.5Y, value of 3 to 6, and chroma of 1 to 4. It is silt loam or silty clay loam.

Factors of Soil Formation

Soil forms through processes that act on accumulated or deposited geologic material. The characteristics of the soil at any given point are determined by the type of parent material; the plant and animal life on and in the soil; the climate under which the soil material accumulated; the relief, or lay of the land; and the length of time that forces of soil formation have been active.

Parent material affects the kind of soil profile that forms and, in extreme cases, determines it almost entirely. Climate determines the amount of water available for leaching and the amount of heat available for physical and chemical changes. Together, climate and plant and animal life act on the parent material that has accumulated and slowly change it into a natural body that has genetically related horizons. Relief modifies the effects of climate and plant and animal life. Finally, time is needed for the transformation of the parent material into a soil. Generally, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made about the effect of any one factor unless conditions about the other four are specified.

Parent Material

Parent material is the unconsolidated mass in which soils form. The deposition of this material is the first step in the development of a soil profile. The characteristics of the material determine the limits of chemical and mineralogical composition of the soil. The soils in Hickory County formed in material weathered from bedrock; loess, or wind-deposited material; and alluvium, or water-deposited material. Some of the soils formed in a combination of these.

Hickory County has three types of residual material. Barco soils formed in material weathered from sandstone. Barden and Hartwell soils formed partly in material weathered from shale. Bardley, Eldon, Gasconade, Gepp, Goss, and Knobby soils formed in material weathered from cherty limestone and dolomite.

Loess, which is made up mainly of silt, was transported into Hickory County by the wind. The principal source of the loess in the county is the flood plains along the Missouri River. Because of the distance from the source, the loess occurs as a thin mantle that is underlain by residuum. Barden and Hartwell soils formed in loess and in the underlying material weathered from shale, and Creldon and Lebanon soils formed in loess and in the underlying cherty material weathered from limestone or dolomite.

Alluvium is material transported by water and deposited on the flood plains along streams and rivers. The major rivers in Hickory County are the Pomme de Terre and the Little Niangua Rivers. The major streams are Starks Creek, Mill Creek, Little Pomme de Terre Creek, Hagies Creek, and Weaubleau Creek. The alluvial material was washed from the watersheds of these rivers and streams and their tributaries. Ashton, Verdigris, Racket, and Moniteau soils formed in silty or loamy alluvium.

Plant and Animal Life

Plants, burrowing animals, insects, bacteria, and fungi are important in the formation of soils. They affect the content of organic matter and plant nutrients, soil structure, and soil porosity.

Many of the soils in Hickory County formed mainly under tall prairie grasses. These soils have a thick, dark surface layer that is high in content of organic matter because of abundant bacteria and the decay of fine grass roots. Gasconade, Hartwell, Knobby, and Sampsel soils formed under prairie vegetation.

Soils that formed in areas of deciduous trees have a light colored surface layer and a low organic matter content. Examples are Ashton, Bardley, Claiborne, Gepp, Goss, Lebanon, McGirk, and Moniteau soils.

On a large acreage in the county, the soils formed under prairie vegetation and then under forest vegetation or under mixed prairie and forest vegetation. These soils have a surface layer that is lighter colored

than that of the prairie soils and somewhat darker than that of forest soils. Examples are Barco, Barden, Creldon, and Eldon soils.

Relief

Relief affects soil formation through its effects on drainage, runoff, infiltration, and related factors, including accelerated erosion. Runoff generally is rapid on steep slopes and is slow to ponded in nearly level areas. In areas where runoff is rapid, little of the water enters the soil and the rate of soil formation is slow. The soils in these areas have indistinct horizons and a thin solum. Gasconade soils are an example. In areas where little water runs off the surface, or where it runs off slowly, more water enters the soil and the rate of soil formation is rapid. The soils in these areas have distinct horizons and have a solum that is thicker than that of the steeper soils. Hartwell soils are an example.

Climate

Climate has been an important factor in the formation of soils in Hickory County. As a result of the climate of long ago, parent material was deposited in the county by wind and water. The more recent climate has either directly or indirectly affected the soils that formed in this material and in other kinds of parent material. Geologic erosion, plant and animal life, and, more recently, accelerated erosion have changed with the climate, and these changes have affected soil formation.

Climate largely determines the rate of weathering in soils. It also influences the type of vegetation that grows on the soils. Hickory County has a temperate, humid continental climate. The average annual precipitation is about 39 inches, and the frost-free period averages 180 days. The prevailing winds are from the south or southeast. These winds are generally warm and moist. Between mid-July and September of most years, however, they are hot and dry and the amount of rainfall is limited. Short periods of excessive rainfall are common in spring, fall, or both. The soils are frozen for short periods in winter. The soil-forming processes are slowed during these periods.

The humid climate of Hickory County favors the relatively rapid breakdown of minerals and the resulting formation of clay. It also favors the translocation of clay downward through the soil profile. The subsoil of Barden and Hartwell soils is high in content of clay and is slowly permeable. As a result, the soils are excessively wet during periods when the amount of rainfall is highest. Conversely, a low available water capacity of the subsoil in these soils causes droughtiness during hot summer months, when the amount of rainfall is low.

Time

The degree of profile development can reflect the length of time that the parent material has been in place and has been subject to weathering. Young soils show little evidence of profile development, or horizon differentiation. Mature soils show the effects of clay movement and leaching. They have distinct horizons.

Verdigris and Racket are among the youngest soils in the county. The material in which these soils formed washed from nearby uplands and was deposited by streams. In areas of extreme erosion and deposition, several inches of this material probably was deposited during a period as short as 1 year. The soils do not have distinct horizons. The upper part of the profile differs only slightly from the rest of the profile. The differences are most likely the result of tillage and incorporation of crop residue into the upper part of the profile in recent years.

Barden and Hartwell are examples of mature soils in the county. These soils have a well developed subsoil that is high in content of clay and that differs strikingly from the layers directly above and below it. Hartwell soils formed in areas of low relief. Runoff was slow, and the soils remained wet during most of the year. Because of a cover of native grasses, erosion was negligible. Water that did not evaporate or run off the surface moved downward through the soils. The low relief and excess water hastened the process of soil formation, considerably shortening the length of time required for the formation of these mature soils. In time the clay particles moved from the surface layer into the lower layers. This translocation of clay resulted in the accumulation of dark clay directly below a severely leached, silty subsurface layer.

Barco soils have been in place as long as the Hartwell soils, but they are fairly youthful soils characterized by weak horizon development. They have a relatively thin, medium textured subsoil. Differences in parent material, animal life, and relief apparently have been the dominant factors in differentiating the Barco and Hartwell soils. A much longer time is required for the Barco soils to develop to maturity.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to flooding.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a channer.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a

particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes easily under gentle pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and the wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed

slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 38 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons are as follows:

O horizon.—An organic layer of fresh and decaying plant residue.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, any plowed or disturbed surface layer.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) granular, prismatic, or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—
Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.
Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.
Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.
Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.
Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.
Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.
Sprinkler.—Water is sprayed over the surface through pipes or nozzles from a pressure system.
Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.
Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil, adversely affecting the specified use.

Permafrost. Layers of soil, or even bedrock, occurring in arctic or subarctic regions, in which a temperature below freezing has existed continuously for a long time.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are—

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the substratum. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the substratum. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from about 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Till plain. An extensive flat to undulating area underlain by glacial till.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, are in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1961-84 at Pomme de Terre Dam)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average daily	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	38.5	17.3	27.9	68	-10	10	1.56	0.55	2.39	4	2.9
February	44.4	22.3	33.4	72	-6	11	1.44	.64	2.11	3	3.6
March	54.7	32.0	43.4	82	6	62	3.11	1.15	4.74	6	1.3
April	67.6	44.1	55.9	87	25	208	3.97	1.97	5.69	7	.2
May	76.1	53.7	64.9	91	34	467	4.69	2.58	6.54	7	.0
June	84.1	62.6	73.4	96	45	702	4.46	2.45	6.22	7	.0
July	90.5	67.4	79.0	103	50	899	3.33	.86	5.29	5	.0
August	89.3	65.5	77.4	103	51	849	3.17	1.05	4.90	5	.0
September	80.4	57.4	68.9	98	37	567	4.64	1.95	6.91	7	.0
October	70.2	45.8	58.0	91	25	269	3.92	1.78	5.75	6	.0
November	55.8	35.1	45.5	79	11	41	2.85	1.06	4.33	5	.5
December	43.8	24.0	33.9	70	-4	23	2.01	.84	3.00	4	2.5
Yearly:											
Average	66.3	43.9	55.1	---	---	---	---	---	---	---	---
Extreme	---	---	---	104	-11	---	---	---	---	---	---
Total	---	---	---	---	---	4,108	39.15	30.87	45.86	66	11.0

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and substracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1961-84 at Pomme de Terre Dam)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Apr. 7	Apr. 14	Apr. 28
2 years in 10 later than--	Apr. 1	Apr. 10	Apr. 23
5 years in 10 later than--	Mar. 21	Apr. 1	Apr. 13
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 26	Oct. 17	Oct. 4
2 years in 10 earlier than--	Nov. 2	Oct. 22	Oct. 8
5 years in 10 earlier than--	Nov. 14	Nov. 1	Oct. 17

TABLE 3.--GROWING SEASON

(Recorded in the period 1961-84 at Pomme de Terre Dam)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	215	192	170
8 years in 10	223	199	176
5 years in 10	238	214	187
2 years in 10	254	229	198
1 year in 10	264	239	206

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
10	Pits and dumps	158	0.1
11	Udorthents, clayey	162	0.1
13B	Sampsel silty clay loam, 2 to 5 percent slopes	7,000	2.6
15	Ashton silt loam	2,300	0.9
20B	Creldon silt loam, 2 to 5 percent slopes	12,100	4.6
23F	Goss very cherty silt loam, 14 to 45 percent slopes	18,600	7.0
30	Verdigris silt loam	2,600	1.0
32	Racket silt loam, loamy substratum	7,100	2.7
50B	McGirk silt loam, 2 to 5 percent slopes	7,300	2.8
51C	Claiborne silt loam, 5 to 9 percent slopes	8,700	3.3
54	Moniteau silt loam	2,050	0.8
55B	Barco sandy loam, 2 to 5 percent slopes	1,300	0.5
58A	Hartwell silt loam, 0 to 2 percent slopes	8,800	3.3
58B2	Hartwell silt loam, 1 to 3 percent slopes, eroded	2,900	1.1
60B	Barden silt loam, 2 to 5 percent slopes	10,400	3.9
63B	Lebanon silt loam, 2 to 5 percent slopes	14,200	5.4
63C	Lebanon silt loam, 5 to 9 percent slopes	1,400	0.5
64B	Plato silt loam, 1 to 3 percent slopes	2,900	1.1
66C	Gepp very cherty silt loam, 3 to 9 percent slopes	13,900	5.3
67C	Bardley very cherty silt loam, 3 to 9 percent slopes	16,500	6.3
67F	Bardley very cherty silt loam, 9 to 50 percent slopes	61,000	23.1
68C	Eldon cherty silt loam, 3 to 9 percent slopes	11,500	4.4
68D	Eldon cherty silt loam, 9 to 14 percent slopes	10,400	3.9
72C	Gasconade-Rock outcrop complex, 3 to 9 percent slopes	2,900	1.1
72F	Gasconade-Rock outcrop complex, 9 to 50 percent slopes	28,650	10.9
74C	Knobby-Rock outcrop complex, 3 to 9 percent slopes	334	0.1
74F	Knobby-Rock outcrop complex, 9 to 50 percent slopes	1,300	0.5
	Water areas less than 40 acres in size	400	0.1
	Water areas more than 40 acres in size	6,800	2.6
	Total	263,654	100.0

TABLE 5.--PRIME FARMLAND

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
13B	Sampsel silty clay loam, 2 to 5 percent slopes (where drained)
15	Ashton silt loam
20B	Creldon silt loam, 2 to 5 percent slopes
30	Verdigris silt loam
32	Racket silt loam, loamy substratum
50B	McGirk silt loam, 2 to 5 percent slopes (where drained)
54	Moniteau silt loam (where drained)
55B	Barco sandy loam, 2 to 5 percent slopes
58A	Hartwell silt loam, 0 to 2 percent slopes (where drained)
58B2	Hartwell silt loam, 1 to 3 percent slopes, eroded (where drained)
60B	Barden silt loam, 2 to 5 percent slopes
63B	Lebanon silt loam, 2 to 5 percent slopes
64B	Plato silt loam, 1 to 3 percent slopes

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Corn	Grain sorghum	Soybeans	Winter wheat	Tall fescue-red clover hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	AUM*
10. Pits and dumps							
11. Udorthents							
13B---------- Sampsel	IIe	86	74	31	35	3.6	7.7
15---------- Ashton	IIw	97	85	36	39	4.2	8.6
20B---------- Creldon	IIe	68	60	26	29	3.0	6.5
23F---------- Goss	VIIe	---	---	---	---	---	3.2
30---------- Verdigris	IIw	100	85	36	40	4.4	9.0
32---------- Racket	IIw	97	85	36	39	4.2	8.6
50B---------- McGirk	IIe	73	65	26	29	3.4	6.5
51C---------- Claiborne	IIIe	76	68	28	30	3.3	6.7
54---------- Moniteau	IIIw	80	72	34	35	3.7	7.4
55B---------- Barco	IIe	83	68	31	36	3.7	7.2
58A---------- Hartwell	IIe	92	80	34	37	4.1	8.2
58B2---------- Hartwell	IIe	86	75	30	34	3.8	7.7
60B---------- Barden	IIe	92	80	34	37	4.1	8.3
63B---------- Lebanon	IIe	55	50	20	35	3.5	7.0
63C---------- Lebanon	IIIe	50	45	18	32	3.2	6.4
64B---------- Plato	IIs	57	52	25	38	3.8	7.5
56C---------- Gepp	IVe	60	55	20	45	3.2	5.5

See footnote at end of table.

TABLE 6.--LAND CAPABILITY CLASSES AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Corn	Grain sorghum	Soybeans	Winter wheat	Tall fescue-red clover hay	Tall fescue
		Bu	Bu	Bu	Bu	Tons	AUM*
67C---------- Bardley	IVe	50	40	15	20	2.3	4.5
67F---------- Bardley	VIIe	---	---	---	---	1.8	3.2
68C---------- Eldon	IVs	56	48	21	23	2.5	5.0
68D---------- Eldon	VIs	---	---	---	---	2.1	3.8
72C: Gasconade------ Rock outcrop.	VIs	---	---	---	---	---	---
72F: Gasconade------ Rock outcrop.	VIIs	---	---	---	---	---	---
74C: Knobby--------- Rock outcrop.	VIs	---	---	---	---	---	---
74F: Knobby--------- Rock outcrop.	VIIs	---	---	---	---	---	---

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Common trees	Site index	Volume*	
15--Ashton	4A	Slight	Slight	Slight	Slight	Pin oak	75	57	Black walnut, eastern cottonwood, green ash.
						Hackberry	---	---	
						Hickory	---	---	
						Red maple	---	---	
						Green ash	---	---	
						American sycamore	---	---	
						American elm	---	---	
						Eastern cottonwood	---	---	
						White oak	---	---	
						Persimmon	---	---	
23F--Goss	3R	Moderate	Moderate	Moderate	Slight	White oak	60	43	Sweetgum, white ash, northern red oak.
						Post oak	---	---	
						Blackjack oak	---	---	
						Black oak	---	---	
30--Verdigris	4A	Slight	Slight	Slight	Slight	Pin oak	75	57	Eastern cottonwood, American sycamore, pin oak, black walnut, green ash.
						Eastern cottonwood	87	95	
						Shagbark hickory	---	---	
						Hackberry	---	---	
						Black walnut	---	---	
						Silver maple	---	---	
						Green ash	---	---	
						White oak	56	39	
32--Racket	5A	Slight	Slight	Slight	Slight	Black walnut	72	54	Black walnut.
						Northern red oak	---	---	
						American sycamore	---	---	
						Black cherry	---	---	
						White oak	---	---	
50B--McGirk	3W	Slight	Severe	Moderate	Moderate	White oak	55	38	White oak, pin oak, green ash, pecan, eastern cottonwood.
51C--Claiborne	4A	Slight	Slight	Slight	Slight	White oak	70	52	Black walnut, shortleaf pine, northern red oak.
						Northern red oak	70	52	
						Black oak	70	52	
54--Moniteau	4W	Slight	Severe	Moderate	Moderate	Pin oak	70	52	White oak, pin oak, green ash, eastern cottonwood, silver maple, black willow, sweetgum, willow oak.

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Potential productivity: Common trees	Site index	Volume*	Trees to plant
63B, 63C-------- Lebanon	3D	Slight	Slight	Slight	Moderate	White oak---------- Black oak---------- Shortleaf pine------	55 60 ---	38 43 ---	Shortleaf pine, white oak, black oak.
64B---------- Plato	3D	Slight	Slight	Slight	Moderate	White oak---------- Black oak---------- Shortleaf pine------	55 60 ---	38 43 ---	Shortleaf pine, post oak, black oak.
66C---------- Gepp	4A	Slight	Slight	Slight	Slight	White oak---------- Shortleaf pine------ Black oak---------- Northern red oak---- Post oak----------	70 75 70 70 ---	52 120 52 52 ---	Black walnut, loblolly pine.
67C---------- Bardley	2D	Slight	Slight	Moderate	Moderate	Post oak----------	45	30	Shortleaf pine, eastern redcedar.
67F---------- Bardley	2R	Moderate	Moderate	Moderate	Moderate	Post oak----------	45	30	Shortleaf pine, eastern redcedar.
72C: Gasconade------	2D	Slight	Moderate	Moderate	Severe	Chinkapin oak------- Eastern redcedar---- White ash---------- Sugar maple--------- Mockernut hickory--- Post oak---------- Blackjack oak-------	40 --- --- --- --- --- ---	26 --- --- --- --- --- ---	Eastern redcedar.
Rock outcrop.									
72F: Gasconade------	2R	Slight	Severe	Moderate	Severe	Chinkapin oak------- Eastern redcedar---- White ash---------- Sugar maple--------- Mockernut hickory--- Post oak---------- Blackjack oak-------	40 --- --- --- --- --- ---	26 --- --- --- --- --- ---	Eastern redcedar.
Rock outcrop.									
74C, 74F: Knobby---------	2F	Moderate	Severe	Severe	Severe	Eastern redcedar----	---	---	Eastern redcedar.
Rock outcrop.									

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

(The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil)

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
10. Pits and dumps					
11. Udorthents					
13B--Sampsel	Lilac	Amur maple, Manchurian crabapple, Amur honeysuckle, autumn olive.	Eastern redcedar, green ash, hackberry, Austrian pine, jack pine, Russian olive.	Honeylocust	---
15--Ashton	---	Amur honeysuckle, lilac, Amur maple, autumn olive.	Eastern redcedar, hackberry, Russian olive.	Green ash, honeylocust, Norway spruce, eastern white pine, pin oak.	---
20B--Creldon	Lilac	Amur honeysuckle, Amur maple, autumn olive, Manchurian crabapple.	Russian olive, Austrian pine, eastern redcedar, jack pine, hackberry, green ash.	Honeylocust	---
23F--Coss	Amur honeysuckle, lilac, fragrant sumac.	Autumn olive	Eastern redcedar, Austrian pine, honeylocust, hackberry, green ash, bur oak, Russian olive.	Siberian elm	---
30--Verdigris	---	Lilac, Amur honeysuckle, Amur maple, autumn olive.	Eastern redcedar	Austrian pine, green ash, hackberry, pin oak, honeylocust, eastern white pine.	Eastern cottonwood.
32--Facket	---	Amur honeysuckle, lilac, Amur maple, autumn olive.	Eastern redcedar	Eastern white pine, green ash, Austrian pine, hackberry, honeylocust, pin oak.	Eastern cottonwood.
50B--McGirk	Lilac	Amur honeysuckle, Amur maple, autumn olive, Manchurian crabapple.	Russian olive, Austrian pine, eastern redcedar, jack pine, hackberry, green ash.	Honeylocust	---

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
51C---------- Claiborne	---	Amur honeysuckle, lilac, Amur maple, autumn olive.	Eastern redcedar, Russian olive, hackberry.	Norway spruce, green ash, honeylocust, pin oak, eastern white pine.	---
54---------- Moniteau	Redosier dogwood	American plum, common chokecherry.	Eastern redcedar, hackberry.	Norway spruce, green ash, golden willow, honeylocust, northern red oak, silver maple.	Eastern cottonwood.
55B---------- Barco	Amur honeysuckle, lilac, fragrant sumac.	Autumn olive------	Green ash, eastern redcedar, bur oak, Russian olive, Austrian pine, hackberry.	Siberian elm, honeylocust.	---
58A, 58B2--------- Hartwell	Lilac----------	Amur maple, Amur honeysuckle, autumn olive, Manchurian crabapple.	Eastern redcedar, hackberry, jack pine, Austrian pine, green ash, Russian olive.	Honeylocust-------	---
60B---------- Barden	Lilac----------	Amur honeysuckle, autumn olive, Manchurian crabapple, Amur maple.	Eastern redcedar, Austrian pine, Russian olive, green ash, hackberry, jack pine.	Honeylocust-------	---
63B, 63C---------- Lebanon	Lilac----------	Amur honeysuckle, Amur maple, autumn olive, Manchurian crabapple.	Austrian pine, eastern redcedar, jack pine, green ash, Russian olive, hackberry.	Honeylocust-------	---
64B---------- Plato	Lilac----------	Amur honeysuckle, Amur maple, autumn olive, Manchurian crabapple.	Russian olive, Austrian pine, eastern redcedar, jack pine, hackberry, green ash.	Honeylocust-------	---
66C. Gepp					
67C, 67F---------- Bardley	Lilac, fragrant sumac, Amur honeysuckle.	Autumn olive------	Russian olive, hackberry, eastern redcedar, bur oak, green ash, Austrian pine, honeylocust.	Siberian elm------	---

TABLE 8.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
68C, 68D---------- Eldon	Amur honeysuckle, lilac, fragrant sumac.	Autumn olive------	Green ash, hackberry, honeylocust, bur oak, Russian olive, Austrian pine, eastern redcedar.	Siberian elm------	---
72C, 72F: Gasconade.					
Rock outcrop.					
74C, 74F: Knobby.					
Rock outcrop.					

TABLE 9.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
10. Pits and dumps					
11. Udorthents					
13B--Sampsel	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, erodes easily.	Severe: wetness.
15--Ashton	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
20B--Creldon	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Moderate: wetness.	Moderate: wetness.
23F--Goss	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: droughty, slope.
30--Verdigris	Severe: flooding.	Slight	Moderate: flooding.	Slight	Moderate: flooding.
32--Racket	Severe: flooding.	Slight	Moderate: small stones, flooding.	Slight	Moderate: flooding.
50B--McGirk	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
51C--Claiborne	Slight	Slight	Severe: slope.	Slight	Moderate: small stones.
54--Moniteau	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
55B--Barco	Slight	Slight	Moderate: slope, thin layer, area reclaim.	Slight	Moderate: thin layer, area reclaim.
58A, 58B2--Hartwell	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
60B--Barden	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight	Slight.
63B--Lebanon	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, droughty.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
63C---- Lebanon	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, droughty.
643---- Plato	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness, droughty.
66C---- Gepp	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Severe: small stones.	Severe: small stones.
67C---- Bardley	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Severe: small stones.	Severe: small stones.
67E---- Bardley	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones, slope.
68C---- Eldon	Moderate: small stones.	Moderate: small stones.	Severe: slope, small stones.	Slight----------	Moderate: small stones, large stones.
68D---- Eldon	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight----------	Moderate: small stones, large stones, slope.
72C: Gasconade----------	Severe: thin layer.	Severe: thin layer.	Severe: large stones, slope, thin layer.	Moderate: large stones.	Severe: large stones, thin layer.
Rock outcrop.					
72F: Gasconade----------	Severe: slope, thin layer.	Severe: slope, thin layer.	Severe: large stones, slope, thin layer.	Severe: slope.	Severe: large stones, slope, thin layer.
Rock outcrop.					
74C: Knobby----------	Severe: thin layer, area reclaim.	Severe: thin layer, area reclaim.	Severe: large stones, small stones, thin layer.	Slight----------	Severe: droughty, thin layer.
Rock outcrop.					
74F: Knobby----------	Severe: slope, thin layer, area reclaim.	Severe: slope, thin layer, area reclaim.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: droughty, slope, thin layer.
Rock outcrop.					

TABLE 10.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
10. Pits and dumps										
11. Udorthents										
13B---- Sampsel	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
15---- Ashton	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
20B---- Creldon	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
23F---- Goss	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
30---- Verdigris	Good	Good	Good	Good	Good	Poor	Fair	Good	Good	Poor.
32---- Racket	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
50B---- McGirk	Fair	Fair	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
51C---- Claiborne	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
54---- Moniteau	Fair	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
55B---- Barco	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
58A---- Hartwell	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
58B2---- Hartwell	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
60B---- Barden	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
63B, 63C---- Lebanon	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
64B---- Plato	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
66C---- Gepp	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
67C---- Bardley	Fair	Good	Good	Fair	Fair	Very poor.	Very poor.	Good	Fair	Very poor.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
67F---------- Bardley	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
68C, 68D---------- Eldon	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
72C, 72F: Gasconade----------	Very poor.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Rock outcrop.										
74C, 74F: Knobby----------	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Rock outcrop.										

TABLE 11.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
13B---------- Sampsel	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
15---------- Ashton	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, low strength.	Moderate: flooding.
20B---------- Creldon	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength.	Moderate: wetness.
23F---------- Goss	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: droughty, slope.
30---------- Verdigris	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
32---------- Racket	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
50B---------- McGirk	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
51C---------- Claiborne	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Moderate: small stones.
54---------- Moniteau	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
55B---------- Barco	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell, frost action.	Moderate: thin layer, area reclaim.
58A, 58B2--------- Hartwell	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
60B---------- Barden	Severe: wetness.	Severe: shrink-swell.	Severe: wetness.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
63B, 63C---------- Lebanon	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength.	Moderate: wetness, droughty.
64B---------- Plato	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength.	Moderate: wetness, droughty.
66C---------- Gepp	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Severe: small stones.
67C---------- Bardley	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: low strength.	Severe: small stones.
67F---------- Bardley	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: small stones, slope.
68C---------- Eldon	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: frost action, shrink-swell.	Moderate: small stones, large stones.
68D---------- Eldon	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, frost action, shrink-swell.	Moderate: small stones, large stones, slope.
72C: Gasconade--------	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: large stones, thin layer.
Rock outcrop.						
72F: Gasconade--------	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: large stones, slope, thin layer.
Rock outcrop.						
74C: Knobby----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: droughty, thin layer.
Rock outcrop.						
74F: Knobby----------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: droughty, slope, thin layer.
Rock outcrop.						

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
10. Pits and dumps					
11. Udorthents					
13B---- Sampsel	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
15---- Ashton	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
20B---- Creldon	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: seepage, wetness, too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
23F---- Goss	Severe: slope.	Severe: seepage, slope, large stones.	Severe: slope, too clayey, large stones.	Severe: slope.	Poor: too clayey, small stones, slope.
30---- Verdigris	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
32---- Racket	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Fair: too clayey.
50B---- McGirk	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
51C---- Claiborne	Moderate: percs slowly.	Severe: slope.	Moderate: too clayey.	Slight----	Fair: too clayey, small stones.
54---- Moniteau	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
55B---- Barco	Severe: thin layer, seepage.	Severe: seepage.	Severe: seepage.	Moderate: seepage.	Poor: area reclaim, thin layer.
58A---- Hartwell	Severe: wetness, percs slowly.	Slight----	Severe: wetness.	Severe: wetness.	Poor: wetness.
58B2---- Hartwell	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness.	Severe: wetness.	Poor: wetness.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
60B Barden	Severe: wetness, percs slowly.	Moderate: slope.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, wetness.
63B Lebanon	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, small stones.
63C Lebanon	Severe: wetness, percs slowly.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, small stones.
64B Plato	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
66C Gepp	Moderate: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
67C Hardley	Severe: thin layer, seepage.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Moderate: seepage.	Poor: area reclaim, too clayey, hard to pack.
67F Hardley	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: slope.	Poor: area reclaim, too clayey, hard to pack.
68C Eldon	Moderate: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
68D Eldon	Moderate: percs slowly, slope.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
72C: Casconade	Severe: thin layer, seepage.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: area reclaim, too clayey, large stones.
Rock outcrop.					
72F: Casconade	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, too clayey, large stones.
Rock outcrop.					
74C: Knobby	Severe: thin layer, seepage.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: area reclaim, thin layer.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
74C: Rock outcrop.					
74F: Knobby	Severe: thin layer, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Severe: seepage, slope.	Poor: area reclaim, slope, thin layer.
Rock outcrop.					

TABLE 13.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
10. Pits and dumps				
11. Udorthents				
13B---- Sampsel	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
15---- Ashton	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
20B---- Creldon	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
23F---- Goss	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
30---- Verdigris	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
32---- Racket	Good----	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
50B---- McGirk	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
51C---- Claiborne	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
54---- Moniteau	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
55B---- Barco	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones, thin layer.
58A, 58B2---- Hartwell	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, wetness.
60B---- Barden	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
63B, 63C---------- Lebanon	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
64B---------- Plato	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
66C---------- Gepp	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
67C---------- Bardley	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
67F---------- Bardley	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
68C, 68D---------- Eldon	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
72C, 72F: Gasconade----------	Poor: area reclaim, large stones, thin layer.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: area reclaim, large stones, thin layer.
Rock outcrop.				
74C: Knobby----------	Poor: area reclaim, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones.
Rock outcrop.				
74F: Knobby----------	Poor: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, large stones, slope.
Rock outcrop.				

TABLE 14.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
10. Pits and dumps						
11. Udorthents						
13B---------- Sampsel	Moderate: slope.	Severe: hard to pack, wetness.	Percs slowly, frost action, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily.
15---------- Ashton	Moderate: seepage.	Severe: piping.	Deep to water	Flooding-------	Erodes easily	Erodes easily.
20B---------- Creldon	Severe: seepage.	Moderate: thin layer, hard to pack, wetness.	Percs slowly, slope.	Slope, wetness, percs slowly.	Erodes easily, wetness.	Erodes easily, rooting depth.
23F---------- Goss	Severe: slope.	Severe: large stones.	Deep to water	Large stones, droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
30---------- Verdigris	Moderate: seepage.	Moderate: piping.	Deep to water	Flooding-------	Favorable------	Favorable.
32---------- Racket	Moderate: seepage.	Severe: piping.	Deep to water	Flooding-------	Favorable------	Favorable.
50B---------- McGirk	Moderate: slope.	Severe: wetness.	Percs slowly, frost action, slope.	Wetness, percs slowly, slope.	Erodes easily, wetness.	Wetness, erodes easily.
51C---------- Claiborne	Moderate: seepage, slope.	Moderate: piping, thin layer.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
54---------- Moniteau	Slight---------	Severe: wetness.	Frost action---	Wetness, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily.
55B---------- Barco	Moderate: seepage, slope.	Severe: thin layer.	Deep to water	Soil blowing, thin layer.	Area reclaim, soil blowing.	Area reclaim.
58A, 58B2--------- Hartwell	Slight---------	Severe: wetness.	Percs slowly---	Wetness, percs slowly.	Erodes easily, wetness.	Wetness, erodes easily, percs slowly.
60B---------- Barden	Moderate: slope.	Moderate: wetness.	Percs slowly, slope.	Wetness, percs slowly, slope.	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
63B, 63C---------- Lebanon	Moderate: slope.	Severe: hard to pack.	Percs slowly, slope.	Slope, wetness, droughty.	Erodes easily, wetness.	Wetness, erodes easily.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
54B---- Plato	Moderate: seepage.	Severe: thin layer.	Percs slowly---	Wetness, droughty.	Erodes easily, wetness, rooting depth.	Wetness, erodes easily, droughty.
56C---- Gepp	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Droughty, slope.	Favorable------	Droughty.
57C---- Bardley	Moderate: seepage, depth to rock, slope.	Severe: piping, hard to pack.	Deep to water	Slope, droughty, thin layer.	Depth to rock, area reclaim.	Droughty, depth to rock.
57F---- Bardley	Severe: slope.	Severe: piping, hard to pack.	Deep to water	Slope, droughty, thin layer.	Slope, depth to rock, area reclaim.	Slope, droughty, depth to rock.
58C---- Eldon	Moderate: seepage, slope.	Severe: hard to pack.	Deep to water	Droughty, slope.	Large stones---	Large stones, droughty.
58D---- Eldon	Severe: slope.	Severe: hard to pack.	Deep to water	Droughty, slope.	Slope, large stones.	Large stones, slope, droughty.
72C: Gasconade--------	Severe: depth to rock, seepage.	Severe: large stones, thin layer.	Deep to water	Slope, large stones, droughty.	Large stones, depth to rock.	Large stones, droughty.
Rock outcrop.						
72F: Gasconade--------	Severe: depth to rock, seepage, slope.	Severe: large stones, thin layer.	Deep to water	Slope, large stones, droughty.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.						
74C: Knobby----------	Severe: depth to rock, seepage.	Severe: thin layer.	Deep to water	Slope, large stones, thin layer.	Large stones, depth to rock.	Large stones, depth to rock.
Rock outcrop.						
74F: Knobby----------	Severe: depth to rock, seepage, slope.	Severe: thin layer.	Deep to water	Slope, large stones, thin layer.	Slope, large stones, depth to rock.	Slope, large stones, depth to rock.
Rock outcrop.						

TABLE 15.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
10. Pits and dumps											
11. Udorthents											
13B---------- Sampsel	0-10	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	90-100	35-50	15-25
	10-70	Silty clay loam, silty clay, clay.	CH	A-7	0	100	100	95-100	95-100	52-75	35-47
15---------- Ashton	0-7	Silt loam--------	ML	A-4	0	95-100	90-100	75-100	60-95	<35	NP-10
	7-60	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	95-100	90-100	85-100	80-100	25-42	5-20
20B---------- Creldon	0-9	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	100	95-100	90-100	85-95	20-40	2-15
	9-30	Silty clay loam, silty clay.	CH	A-7	0	90-100	85-100	85-95	80-95	50-60	25-35
	30-41	Silt loam, silty clay loam, cherty silty clay loam.	CL	A-6, A-7	0-5	75-100	70-100	65-95	60-90	35-45	15-25
	41-46	Extremely cherty silty clay, cherty silty clay.	GC, CH, SC	A-2, A-7	5-35	45-75	40-75	35-70	30-65	55-70	35-50
	46-60	Very cherty clay, extremely cherty clay, cherty clay.	GC, CH, SC	A-2, A-7	5-35	45-75	40-75	35-70	30-65	55-80	35-60
23F---------- Goss	0-12	Very cherty silt loam.	GM, GC, GM-GC	A-2	10-40	40-60	35-55	30-50	25-35	20-30	2-10
	12-22	Very cherty silty clay loam, very cherty silt loam.	GM, GC, GM-GC	A-2	10-40	40-60	35-55	30-50	25-35	20-30	2-10
	22-44	Cherty silty clay loam, extremely cherty silty clay, very cherty clay.	GC, SC	A-7, A-2-7	10-45	45-70	20-65	20-50	20-45	50-70	30-40
	44-60	Silty clay, clay, cherty clay.	CL, CH	A-7	0-10	70-100	70-100	70-95	70-95	45-65	20-35
30---------- Verdigris	0-18	Silt loam--------	CL, CL-ML, ML	A-4, A-6	0	100	100	95-100	65-100	22-35	2-13
	18-72	Silt loam, silty clay loam.	CL	A-4, A-6, A-7	0	100	100	95-100	80-100	30-45	8-23
32---------- Racket	0-6	Silt loam--------	CL-ML, CL	A-4, A-6	0	90-100	85-100	75-95	55-85	25-35	5-12
	6-36	Silt loam, loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	90-100	85-100	75-95	55-95	25-40	5-20
	36-60	Loam, fine sandy loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0	85-100	80-100	60-95	35-75	25-35	5-12

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
50B----------	0-5	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	90-100	85-100	25-40	5-15
McGirk	5-9	Silty clay loam	CL, CH	A-7	0	100	100	90-100	90-100	40-55	15-30
	9-46	Silty clay, silty clay loam.	CH, MH	A-7	0	100	100	95-100	90-100	50-75	25-40
	46-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	90-100	90-100	85-100	80-100	35-50	11-25
51C----------	0-10	Silt loam--------	ML, CL, CL-ML	A-4	0-5	85-100	70-100	65-90	55-80	24-35	4-10
Claiborne	10-60	Silty clay loam, cherty silty clay loam.	CL	A-4, A-6	0-5	85-100	70-100	65-90	60-80	28-40	8-20
54----------	0-25	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	90-100	85-100	25-35	5-15
Moniteau	25-70	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	85-100	80-95	30-45	15-25
55B----------	0-12	Sandy loam--------	ML, SM, SM-SC, CL-ML	A-4	0	100	100	70-85	40-55	15-25	2-7
Barco	12-27	Loam, sandy clay loam, clay loam.	CL, SC	A-6	0-5	85-100	75-100	75-100	45-80	25-40	11-22
	27-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
58A----------	0-6	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	80-100	20-35	5-15
Hartwell	6-10	Silty clay loam, silt loam.	CL	A-6	0	100	100	95-100	90-100	30-40	15-20
	10-34	Clay, silty clay	CH	A-7	0	100	100	95-100	90-100	50-65	30-40
	34-60	Silt loam, silty clay loam, silty clay.	CL	A-6, A-7	0	100	100	95-100	90-100	35-45	20-25
58B2----------	0-7	Silt loam--------	CL-ML, CL	A-4, A-6	0	100	100	95-100	80-100	20-35	5-15
Hartwell	7-30	Clay, silty clay	CH	A-7	0	100	100	95-100	90-100	50-65	30-40
	30-60	Silt loam, silty clay loam, silty clay.	CL	A-6, A-7	0	100	100	95-100	90-100	35-45	20-25
60B----------	0-7	Silt loam--------	CL	A-4, A-6	0	100	100	90-100	75-85	25-35	8-15
Barden	7-12	Silty clay loam	CL	A-6, A-7	0	100	100	95-100	80-90	30-45	15-25
	12-39	Silty clay, silty clay loam, clay loam.	CL, CH	A-7	0	100	100	90-100	80-95	40-60	25-40
	39-60	Silty clay loam, clay loam, sandy clay loam.	CL	A-6, A-7	0	100	90-100	90-100	50-90	30-45	15-25

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
63B, 63C--- Lebanon	0-6	Silt loam	CL-ML, CL	A-4, A-6	0-5	85-100	85-100	80-95	60-75	22-35	5-15
	6-17	Silt loam, silty clay loam.	CL	A-6	0-5	85-95	80-95	75-95	60-75	30-40	11-20
	17-24	Silty clay loam, silty clay.	CL	A-7	0-5	85-95	70-95	65-90	55-75	40-50	20-30
	24-33	Cherty silt loam, silty clay loam, silt loam.	CL, SC, GC	A-7, A-2, A-6	0-10	55-90	30-85	25-80	20-65	35-45	15-20
	33-43	Cherty silty clay loam, very cherty silty clay loam.	CL, GC	A-2, A-6, A-7	0-10	55-75	30-75	25-70	20-55	35-45	15-20
	43-60	Cherty silty clay, clay, silty clay.	CL, CH, SC, GC	A-7, A-2-7	0-10	65-95	30-90	25-90	20-85	45-80	25-45
64B--- Plato	0-11	Silt loam	CL-ML, ML	A-4	0-5	100	95-100	90-100	70-90	<25	NP-6
	11-26	Silty clay loam, silty clay, clay.	CL, CH	A-7	0-5	85-100	80-100	75-95	65-85	40-55	20-35
	26-40	Silt loam, silty clay loam, cherty silty clay loam.	CL, SC, GC	A-2, A-6, A-7	0-10	55-90	30-85	25-80	20-65	35-45	15-20
	40-60	Very cherty clay, cherty clay, cherty silty clay loam.	CL, CH, GC, SC	A-7	0-5	40-75	40-70	35-70	35-65	45-60	30-45
66C--- Sepp	0-13	Very cherty silt loam.	GM, GC, SM-SC, SM	A-1, A-2	10-30	30-70	20-50	10-40	5-20	<30	NP-10
	13-70	Clay, cherty clay	MH, CH	A-7	0-15	70-100	70-100	65-100	60-95	51-75	25-40
67C, 67F--- Bardley	0-14	Very cherty silt loam.	GC, CL, SC	A-6, A-2	0-15	40-90	30-75	30-70	25-65	30-40	10-20
	14-27	Silty clay, clay, cherty clay.	GM, SM, MH	A-7	0-10	70-95	50-95	50-90	40-85	50-70	20-35
	27	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
68C, 68D--- Eldon	0-10	Cherty silt loam	ML, CL-ML, CL	A-4	5-25	70-95	65-90	60-85	55-80	20-30	2-8
	10-19	Very cherty silty clay loam, cherty silty clay loam.	GC, CH, CL	A-2-7, A-7	5-15	40-60	30-55	20-55	20-55	40-60	20-30
	19-24	Extremely cherty silty clay loam, extremely cherty silty clay.	GC, GP-GC	A-2-7	0-10	20-35	15-25	10-25	10-25	40-60	20-30
	24-60	Silty clay, cherty clay, cherty silty clay.	CL, CH, ML, MH	A-7	0-15	80-100	65-100	65-100	65-100	45-95	25-50

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
72C, 72F:											
Gasconade-------	0-5	Flaggy silty clay loam.	CL	A-6	20-50	75-90	70-85	60-75	55-65	30-40	15-25
	5-13	Flaggy silty clay, flaggy clay, very flaggy silty clay loam.	GC	A-2-7	20-70	45-55	40-50	30-40	20-35	55-65	35-45
	13	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
74C, 74F:											
Knobby----------	0-5	Very cobbly loam	CL-ML, CL, GC, GM-GC	A-4	15-40	65-85	60-85	50-75	40-65	20-30	4-10
	5-9	Very gravelly sandy loam, very gravelly loam, very cobbly loam.	GC, SC, GM-GC, SM-SC	A-2-4, A-4, A-1-b	15-40	56-75	45-75	35-65	20-50	20-30	4-10
	9	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
10. Pits and dumps										
11. Udorthents										
13B	0-10	27-35	1.30-1.50	0.2-0.6	0.21-0.24	5.6-7.3	Moderate	0.37	2	3-4
Sampsel	10-70	35-60	1.40-1.60	0.06-0.2	0.11-0.13	5.6-7.8	High	0.37		
15	0-7	10-25	1.20-1.40	0.6-2.0	0.16-0.23	5.6-7.3	Low	0.32	5	2-4
Ashton	7-60	18-34	1.20-1.50	0.6-2.0	0.18-0.23	5.6-7.3	Low	0.43		
20B	0-9	10-25	1.20-1.40	0.6-2.0	0.22-0.24	4.5-7.3	Low	0.32	4	1-3
Creldon	9-30	35-45	1.30-1.50	0.2-0.6	0.12-0.17	4.5-6.5	Moderate	0.32		
	30-41	25-35	1.60-1.90	<0.06	0.07-0.12	3.6-6.0	Low	0.43		
	41-46	40-60	1.30-1.55	2.0-6.0	0.05-0.12	4.5-6.0	High	0.32		
	46-60	40-70	1.30-1.55	2.0-6.0	0.04-0.10	4.5-6.0	High	0.32		
23F	0-12	20-27	1.10-1.30	2.0-6.0	0.06-0.10	4.5-6.5	Low	0.10	2	.5-2
Goss	12-22	20-30	1.10-1.30	2.0-6.0	0.06-0.10	4.5-6.0	Low	0.10		
	22-44	35-60	1.30-1.50	0.6-2.0	0.04-0.09	4.5-6.0	Moderate	0.10		
	44-60	50-90	1.40-1.60	0.6-2.0	0.06-0.10	4.5-7.3	Moderate	0.24		
30	0-18	15-27	1.30-1.40	0.6-2.0	0.20-0.24	5.6-7.3	Low	0.32	5	2-4
Verdigris	18-72	18-35	1.40-1.65	0.6-2.0	0.17-0.22	5.6-7.3	Moderate	0.32		
32	0-6	15-27	1.25-1.45	0.6-2.0	0.18-0.24	6.1-7.3	Low	0.32	5	2-3
Racket	6-36	18-35	1.25-1.45	0.6-2.0	0.14-0.20	6.1-7.3	Moderate	0.32		
	36-60	15-27	1.25-1.45	0.6-2.0	0.12-0.16	6.1-7.3	Low	0.32		
50B	0-5	15-27	1.30-1.45	0.6-2.0	0.22-0.24	5.1-6.5	Low	0.43	3	1-2
McGirk	5-9	27-40	1.30-1.40	0.2-0.6	0.18-0.20	4.5-5.5	Moderate	0.43		
	9-46	35-50	1.25-1.35	0.06-0.2	0.10-0.18	4.5-6.0	High	0.32		
	46-60	20-35	1.30-1.40	0.2-0.6	0.14-0.18	4.5-6.0	Moderate	0.32		
51C	0-10	20-32	1.30-1.50	0.6-2.0	0.17-0.21	4.5-6.0	Low	0.37	5	1-3
Claiborne	10-60	27-35	1.35-1.55	0.6-2.0	0.17-0.20	4.5-5.5	Moderate	0.32		
54	0-25	25-35	1.20-1.40	0.6-2.0	0.21-0.23	5.1-7.3	Low	0.43	5	1-2
Moniteau	25-70	27-35	1.30-1.50	0.2-0.6	0.18-0.20	4.5-6.0	Moderate	0.43		
55B	0-12	10-20	1.40-1.55	2.0-6.0	0.16-0.18	5.1-7.3	Low	0.24	4	1-3
Barco	12-27	18-35	1.40-1.60	0.6-2.0	0.12-0.16	4.5-6.5	Moderate	0.32		
	27-60	---	---	---	---	---		----		
58A	0-6	15-27	1.30-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.43	3	2-4
Hartwell	6-10	15-32	1.30-1.40	0.2-0.6	0.18-0.20	5.1-6.5	Moderate	0.43		
	10-34	40-55	1.30-1.40	0.06-0.2	0.09-0.13	5.1-6.5	High	0.32		
	34-60	25-45	1.30-1.40	0.06-0.2	0.18-0.20	5.1-7.3	Moderate	0.43		
58B2	0-7	15-27	1.30-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.43	3	2-4
Hartwell	7-30	40-55	1.30-1.40	0.06-0.2	0.09-0.13	5.1-6.5	High	0.32		
	30-60	25-45	1.30-1.40	0.06-0.2	0.18-0.20	5.1-7.3	Moderate	0.43		

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
60B----------	0-7	15-27	1.40-1.50	0.6-2.0	0.21-0.24	5.1-7.3	Low----------	0.37	3	1-2
Barden	7-12	28-35	1.35-1.45	0.2-0.6	0.18-0.20	4.5-6.5	Moderate-----	0.37		
	12-39	36-55	1.25-1.40	0.06-0.2	0.11-0.19	4.5-6.5	High---------	0.37		
	39-60	28-40	1.30-1.45	0.2-0.6	0.10-0.14	4.5-6.5	Moderate-----	0.37		
63B, 63C----------	0-6	10-20	1.20-1.50	0.6-2.0	0.18-0.22	5.6-6.5	Low----------	0.43	4	.5-2
Lebanon	6-17	20-30	1.30-1.50	0.6-2.0	0.14-0.20	4.5-5.5	Low----------	0.43		
	17-24	35-45	1.30-1.50	0.2-0.6	0.13-0.20	4.5-5.5	Moderate-----	0.32		
	24-33	25-40	1.60-1.90	<0.06	0.01-0.05	4.5-5.5	Low----------	0.32		
	33-43	25-40	1.60-1.90	<0.06	0.06-0.10	4.5-5.5	Low----------	0.32		
	43-60	40-80	1.40-1.60	0.06-0.2	0.02-0.06	4.5-5.5	Moderate-----	0.32		
64B----------	0-11	12-20	1.20-1.50	0.6-2.0	0.20-0.22	5.1-7.3	Low----------	0.43	4	1-2
Plato	11-26	27-45	1.30-1.50	0.2-0.6	0.10-0.18	3.6-5.5	Moderate-----	0.32		
	26-40	25-40	1.60-1.90	<0.06	0.01-0.05	4.5-5.5	Low----------	0.32		
	40-60	35-45	1.40-1.60	0.6-2.0	0.02-0.06	4.5-6.0	Moderate-----	0.24		
66C----------	0-13	10-25	1.25-1.45	0.6-2.0	0.06-0.12	4.5-6.5	Low----------	0.24	4	2-4
Gepp	13-70	65-85	1.15-1.30	0.6-2.0	0.08-0.18	5.1-6.5	Moderate-----	0.28		
67C, 67F----------	0-14	25-35	1.40-1.55	0.6-2.0	0.12-0.17	4.5-6.5	Moderate-----	0.28	3	.5-2
Bardley	14-27	50-85	1.20-1.40	0.6-2.0	0.08-0.12	4.5-7.3	Moderate-----	0.28		
	27	---	---	---	---	---	----------	----		
68C, 68D----------	0-10	15-27	1.40-1.55	2.0-6.0	0.13-0.18	4.5-7.3	Low----------	0.24	2	1-3
Eldon	10-19	35-60	1.35-1.45	0.6-2.0	0.05-0.14	4.5-7.3	Moderate-----	0.24		
	19-24	35-60	1.35-1.45	0.6-2.0	0.03-0.08	4.5-7.3	Moderate-----	0.24		
	24-60	35-95	1.35-1.45	0.6-2.0	0.10-0.14	4.5-7.8	Moderate-----	0.24		
72C, 72F:										
Gasconade-------	0-5	35-40	1.35-1.50	0.6-2.0	0.10-0.12	6.1-7.8	Moderate-----	0.20	2	2-4
	5-13	35-60	1.45-1.70	0.2-0.6	0.05-0.07	6.1-7.8	Moderate-----	0.20		
	13	---	---	---	---	---	----------	----		
Rock outcrop.										
74C, 74F:										
Knobby----------	0-5	10-18	1.30-1.50	0.6-2.0	0.13-0.17	6.6-7.8	Low----------	0.24	1	1-2
	5-9	10-18	1.30-1.50	0.6-2.0	0.07-0.11	6.6-7.8	Low----------	0.17		
	9	---	---	---	---	---	----------	----		
Rock outcrop.										

TABLE 17.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "occasional," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Potential frost action	Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness		Uncoated steel	Concrete
					Ft			In				
10. Pits and dumps												
11. Udorthents												
13B--- Sampsel	D	None	---	---	0-1.5	Perched	Nov-May	>60	---	High	High	Low.
15--- Ashton	B	Occasional	Very brief	Nov-May	>6.0	---	---	>60	---	---	Low	Low.
20B--- Creldon	C	None	---	---	1.5-3.0	Perched	Nov-May	>60	---	Moderate	High	High.
23F--- Goss	B	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
30--- Verdigris	B	Occasional	Very brief	Nov-May	>6.0	---	---	>60	---	---	Low	Low.
32--- Racket	B	Occasional	Very brief	Nov-May	3.5-6.0	Apparent	Nov-May	>60	---	Moderate	Moderate	Low.
50B--- McGirk	D	None	---	---	0.5-2.0	Perched	Nov-May	>60	---	High	High	High.
51C--- Claiborne	B	None	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
54--- Moniteau	C/D	Occasional--	Brief-----	Nov-May	0-1.0	Apparent	Nov-May	>60	---	High	High	High.
55B--- Barco	B	None	---	---	>6.0	---	---	20-40	Soft	---	Low	Moderate.
58A, 58B2--- Hartwell	D	None	---	---	0.5-1.5	Perched	Nov-May	>60	---	---	High	Moderate.
60B--- Barden	C	None	---	---	2.0-3.0	Perched	Nov-May	>60	---	---	High	Moderate.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion		
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Potential frost action	Uncoated steel	Concrete
					Ft			In				
63B, 63C---------- Lebanon	C	None--------	---	---	1.0-2.0	Perched	Nov-May	>60	---	Moderate	Moderate	High.
64B---------- Plato	C	None--------	---	---	1.0-2.5	Perched	Nov-May	>60	---	Moderate	High-----	High.
66C---------- Gepp	B	None--------	---	---	>6.0	---	---	>60	---	---	High-----	High.
67C, 67F---------- Bardley	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate	Moderate.
68C, 68D---------- Eldon	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	Moderate.
72C, 72F: Gasconade--------	D	None--------	---	---	>6.0	---	---	4-20	Hard	Moderate	High-----	Low.
Rock outcrop.												
74C, 74F: Knobby----------	D	None--------	---	---	>6.0	---	---	6-20	Hard	Low------	Low------	Low.
Rock outcrop.												

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Ashton	Fine-silty, mixed, mesic Mollic Hapludalfs
Barco	Fine-loamy, mixed, thermic Mollic Hapludalfs
Barden	Fine, mixed, thermic Aquollic Hapludalfs
Bardley	Very fine, mixed, mesic Typic Hapludalfs
Claiborne	Fine-loamy, siliceous, mesic Typic Paleudults
Creldon	Fine, mixed, mesic Mollic Fragiudalfs
Eldon	Clayey-skeletal, mixed, mesic Mollic Paleudalfs
Gasconade	Clayey-skeletal, mixed, mesic Lithic Hapludolls
Gepp	Very fine, mixed, mesic Typic Paleudalfs
Goss	Clayey-skeletal, mixed, mesic Typic Paleudalfs
Hartwell	Fine, mixed, thermic Typic Argialbolls
Knobby	Loamy-skeletal, mixed, mesic Lithic Hapludolls
Lebanon	Fine, mixed, mesic Typic Fragiudalfs
McGirk	Fine, montmorillonitic, mesic, sloping Typic Ochraqualfs
Moniteau	Fine-silty, mixed, mesic Typic Ochraqualfs
Plato	Fine, mixed, mesic Aquic Fragiudalfs
Racket	Fine-loamy, mixed, mesic Cumulic Hapludolls
Sampsel	Fine, montmorillonitic, mesic, sloping Typic Argiaquolls
Udorthents	Mixed, mesic Typic Udorthents
Verdigris	Fine-silty, mixed, thermic Cumulic Hapludolls

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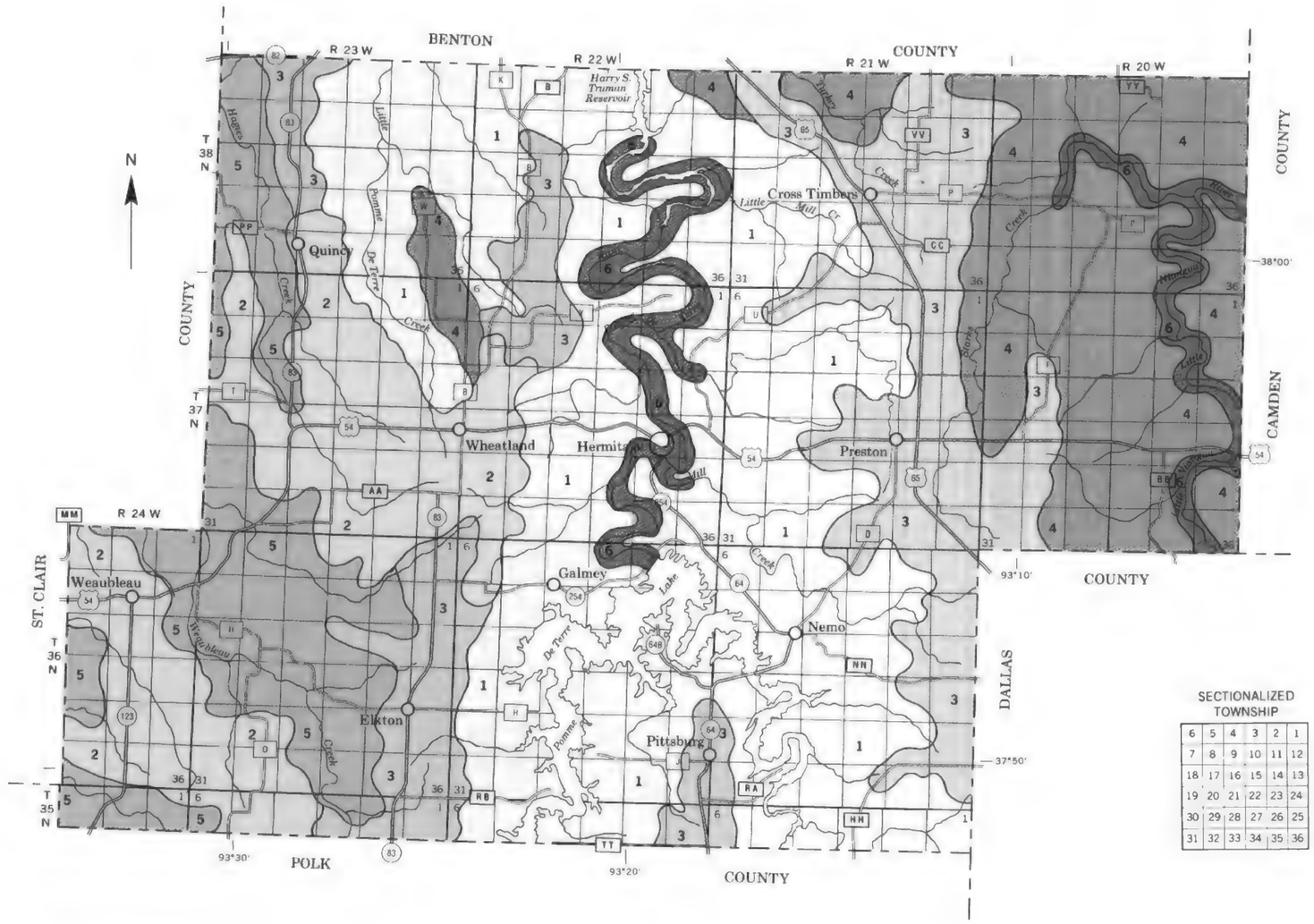


LEGEND

1	BARDLEY-GASCONADE ASSOCIATION: Shallow and moderately deep, gently sloping to very steep, well drained and somewhat excessively drained soils; on uplands
2	HARTWELL-ELDON-BARDEN ASSOCIATION: Deep, nearly level to strongly sloping, somewhat poorly drained to well drained soils; on uplands
3	ELDON-CRELDON ASSOCIATION: Deep, gently sloping to strongly sloping, moderately well drained and well drained soils; on uplands
4	BARDLEY-LEBANON-GEPP ASSOCIATION: Moderately deep and deep, gently sloping to very steep, well drained and moderately well drained soils; on uplands
5	GOSS-GASCONADE ASSOCIATION: Deep and shallow, gently sloping to very steep, well drained and somewhat excessively drained soils; on uplands
6	RACKET-CLAIBORNE-ASHTON ASSOCIATION: Deep, nearly level and moderately sloping, well drained soils; on flood plains, foot slopes, and side slopes

Compiled 1988

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

Index Map

Welcome Page

Manuscript

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
MISSOURI AGRICULTURAL EXPERIMENT STATION

GENERAL SOIL MAP

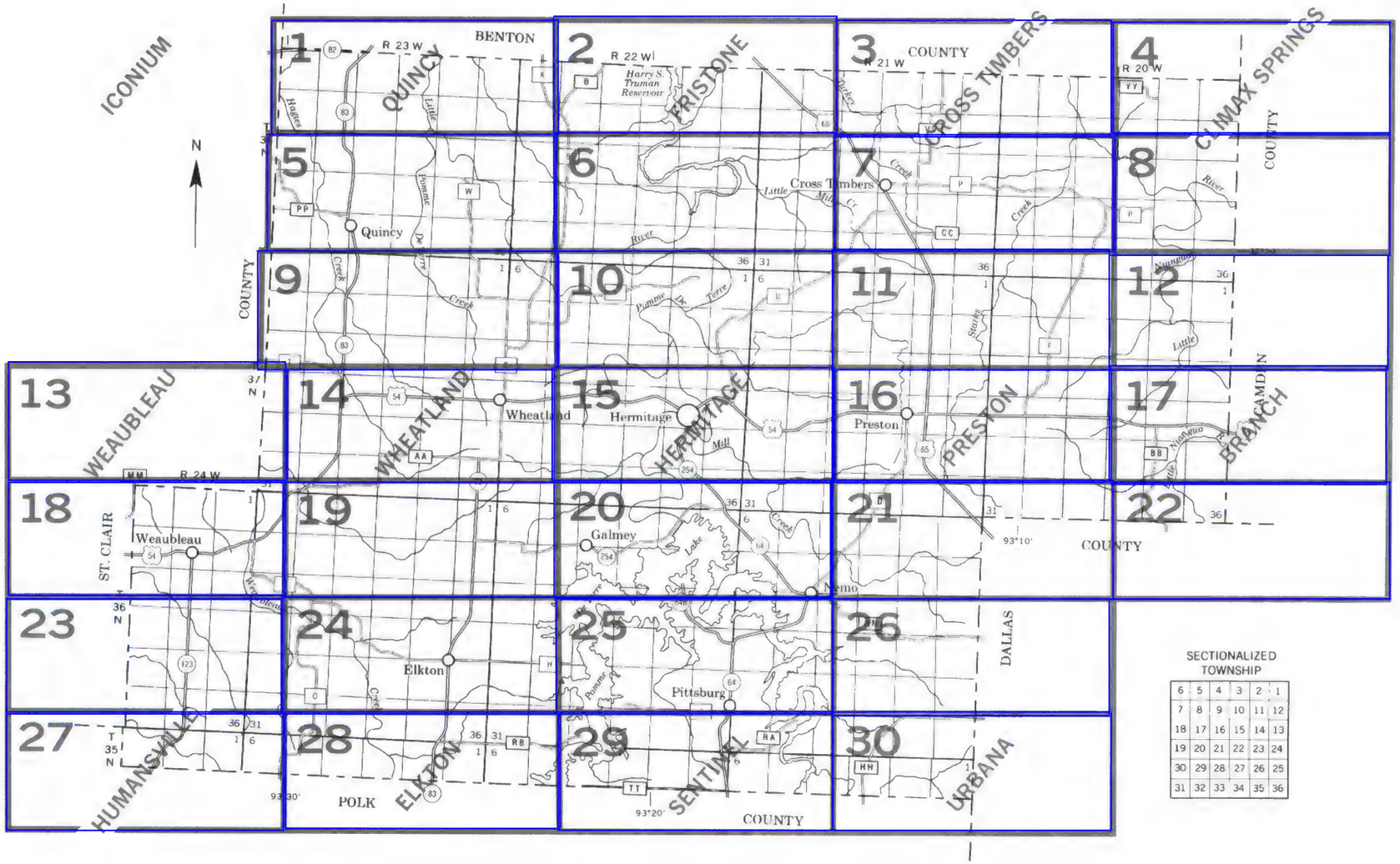
HICKORY COUNTY, MISSOURI

Scale 1:190,080

1 0 1 2 3 Mi

1 0 3 6 Km

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



General Soil Map

Welcome Page

Manuscript

SECTIONALIZED TOWNSHIP

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

INDEX TO MAP SHEETS

HICKORY COUNTY, MISSOURI

Scale 1:190,080

1 0 1 2 3 Mi

1 0 3 6 Km

Index Map Welcome Page Manuscript

SOIL LEGEND

Map symbols consist of numbers or a combination of numbers and a letter. The initial numbers represent the kind of soil. A capital letter following these numbers indicates the class of slope. Symbols without a slope letter are for nearly level soils, units of higher taxonomic classification, or miscellaneous areas. A final number of 2 following the slope letter indicates that the soil is eroded.

SYMBOL	NAME
10	Pits and dumps
11	Udorthents, clayey
13B	Sampsel silty clay loam, 2 to 5 percent slopes
15	Ashton silt loam
20B	Creldon silt loam, 2 to 5 percent slopes
23F	Goss very cherty silt loam, 14 to 45 percent slopes
30	Verdigris silt loam
32	Racket silt loam, loamy substratum
50B	McGirk silt loam, 2 to 5 percent slopes
51C	Claiborne silt loam, 5 to 9 percent slopes
54	Moniteau silt loam
55B	Barco sandy loam, 2 to 5 percent slopes
58A	Hartwell silt loam, 0 to 2 percent slopes
58B2	Hartwell silt loam, 1 to 3 percent slopes, eroded
60B	Barden silt loam, 2 to 5 percent slopes
63B	Lebanon silt loam, 2 to 5 percent slopes
63C	Lebanon silt loam, 5 to 9 percent slopes
64B	Plato silt loam, 1 to 3 percent slopes
66C	Gepp very cherty silt loam, 3 to 9 percent slopes
67C	Bardley very cherty silt loam, 3 to 9 percent slopes
67F	Bardley very cherty silt loam, 9 to 50 percent slopes
68C	Eldon cherty silt loam, 3 to 9 percent slopes
68D	Eldon cherty silt loam, 9 to 14 percent slopes
72C	Gasconade-Rock outcrop complex, 3 to 9 percent slopes
72F	Gasconade-Rock outcrop complex, 9 to 50 percent slopes
74C	Knobby-Rock outcrop complex, 3 to 9 percent slopes
74F	Knobby-Rock outcrop complex, 9 to 50 percent slopes

CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

CULTURAL FEATURES

BOUNDARIES

- National, state or province
- County or parish
- Minor civil division
- Reservation (national forest or park, state forest or park, and large airport)
- Land grant
- Limit of soil survey (label)
- Field sheet matchline and neatline
- AD HOC BOUNDARY (label)
- Small airport, airfield, park, oilfield, cemetery, or flood pool (Swift Airport; FLOOD POOL LINE)
- STATE COORDINATE TICK
- LAND DIVISION CORNER (sections and land grants)

ROADS

- Divided (median shown if scale permits)
- Other roads
- Trail

ROAD EMBLEM & DESIGNATIONS

- Interstate (21)
- Federal (173)
- State (76)
- County, farm or ranch (1283)

- RAILROAD
- POWER TRANSMISSION LINE (normally not shown)
- PIPE LINE (normally not shown)
- FENCE (normally not shown)

LEVEES

- Without road
- With road
- With railroad

DAMS

- Large (to scale)
- Medium or Small (water; w)

PITS

- Gravel pit
- Mine or quarry

MISCELLANEOUS CULTURAL FEATURES

- Farmstead, house (omit in urban areas)
- Church
- School
- Indian mound (label) (Indian Mound)
- Located object (label) (Tower)
- Tank (label) (Gas)
- Wells, oil or gas
- Windmill
- Kitchen midden

WATER FEATURES

DRAINAGE

- Perennial, double line
- Perennial, single line
- Intermittent
- Drainage end
- Canals or ditches
  - Double-line (label) (CANAL)
  - Drainage and/or irrigation

LAKES, PONDS AND RESERVOIRS

- Perennial (water; w)
- Intermittent (int; i)

MISCELLANEOUS WATER FEATURES

- Marsh or swamp
- Spring
- Well, artesian
- Well, irrigation
- Wet spot

SPECIAL SYMBOLS FOR SOIL SURVEY

- SOIL DELINEATIONS AND SYMBOLS (20B; 68C)
- ESCARPMENTS
  - Bedrock (points down slope)
  - Other than bedrock (points down slope)
- SHORT STEEP SLOPE
- GULLY
- DEPRESSION OR SINK
- SOIL SAMPLE (normally not shown)
- MISCELLANEOUS
  - Blowout
  - Clay spot
  - Gravelly spot
  - Gumbo, slick or scabby spot (sodic)
  - Dumps and other similar non soil areas
  - Prominent hill or peak
  - Rock outcrop (includes sandstone and shale)
  - Saline spot
  - Sandy spot
  - Severely eroded spot
  - Slide or slip (tips point upslope)
  - Stony spot, very stony spot

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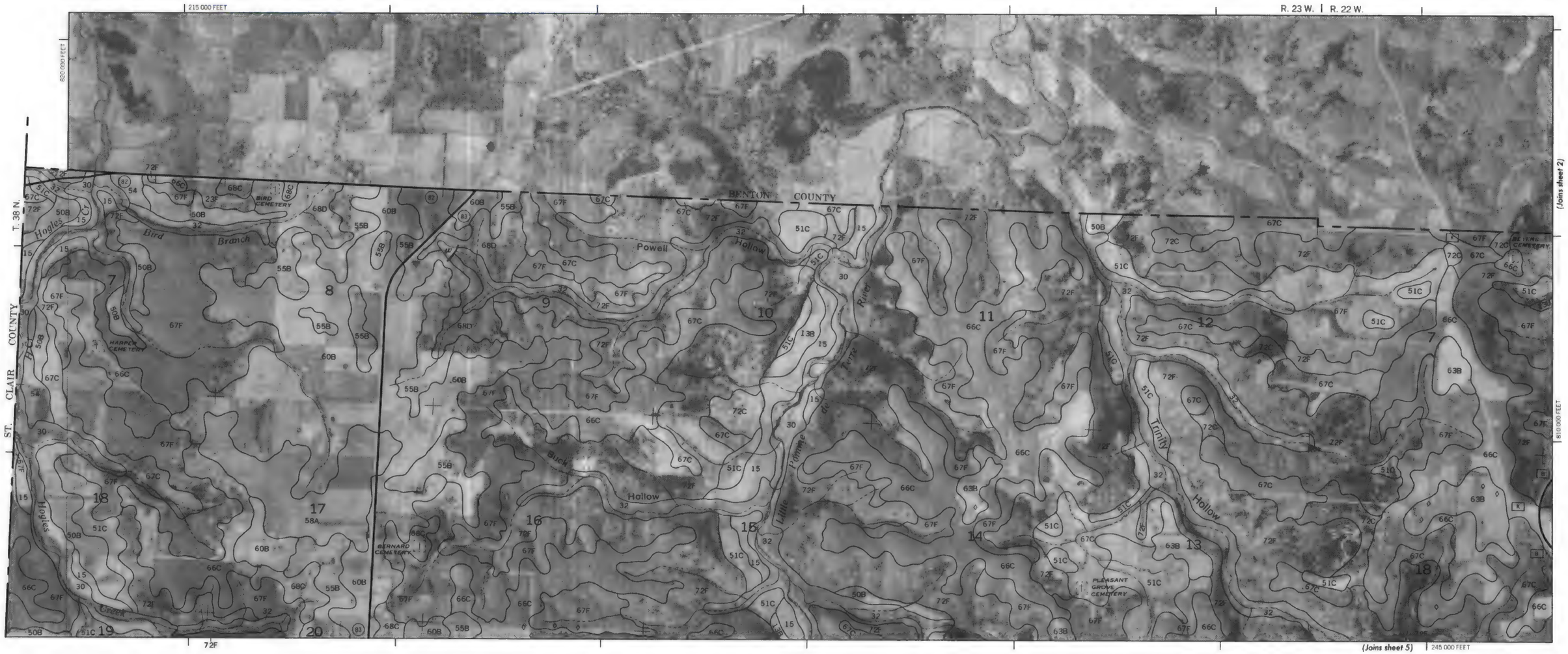

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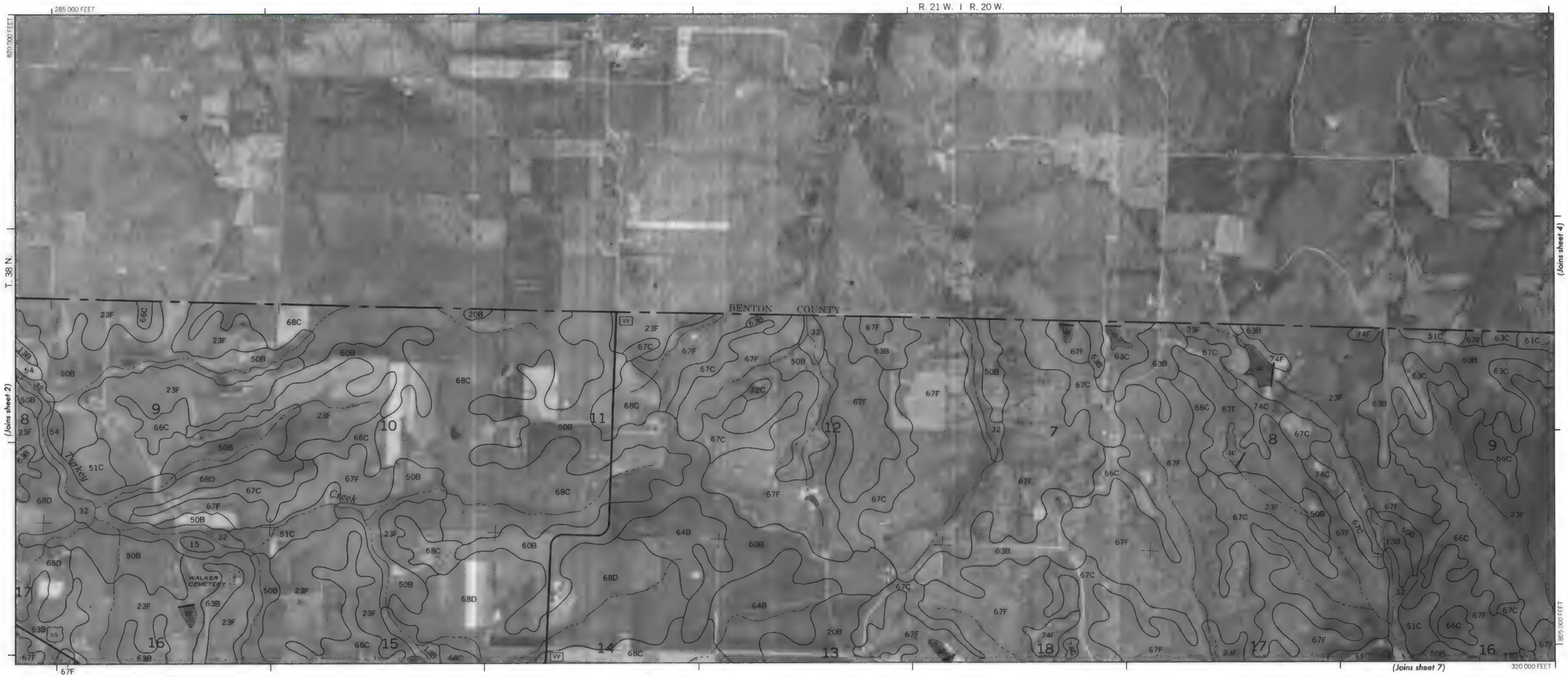

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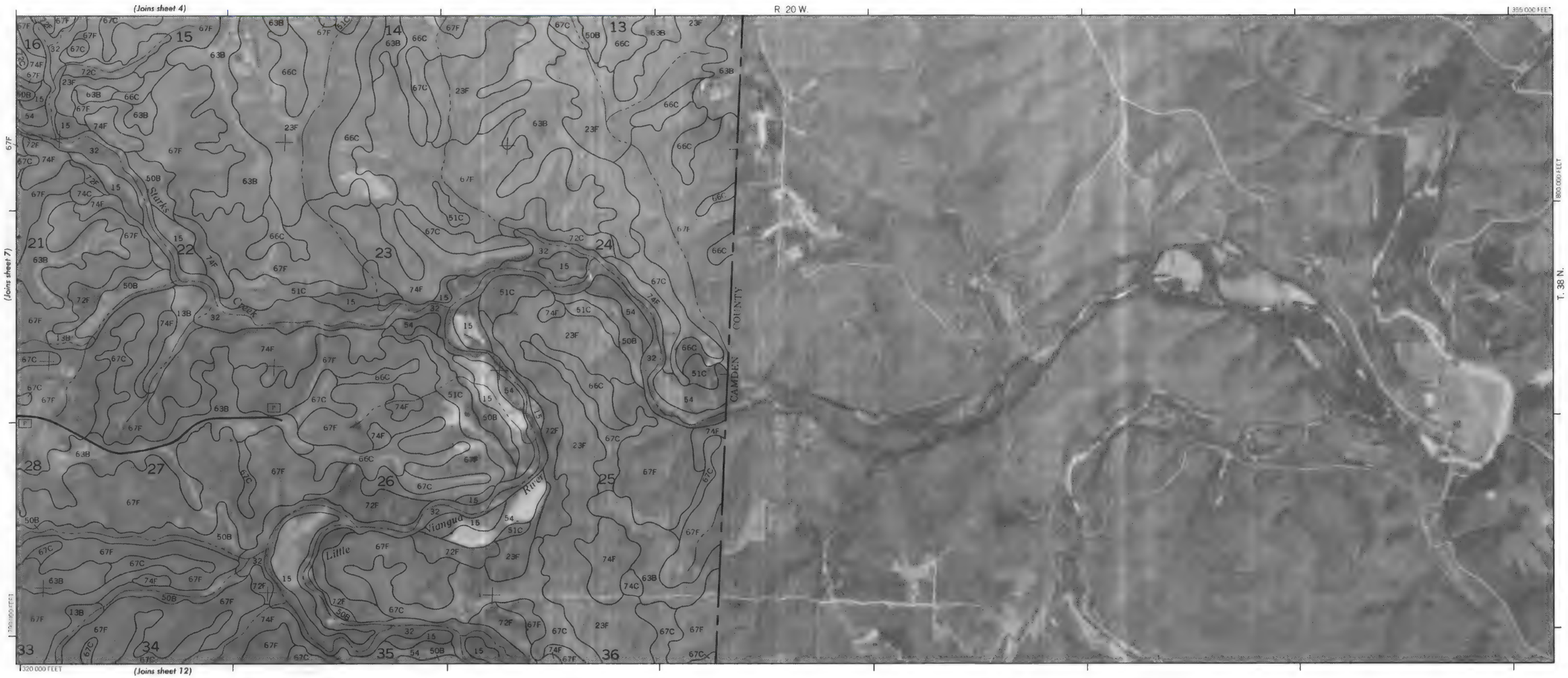

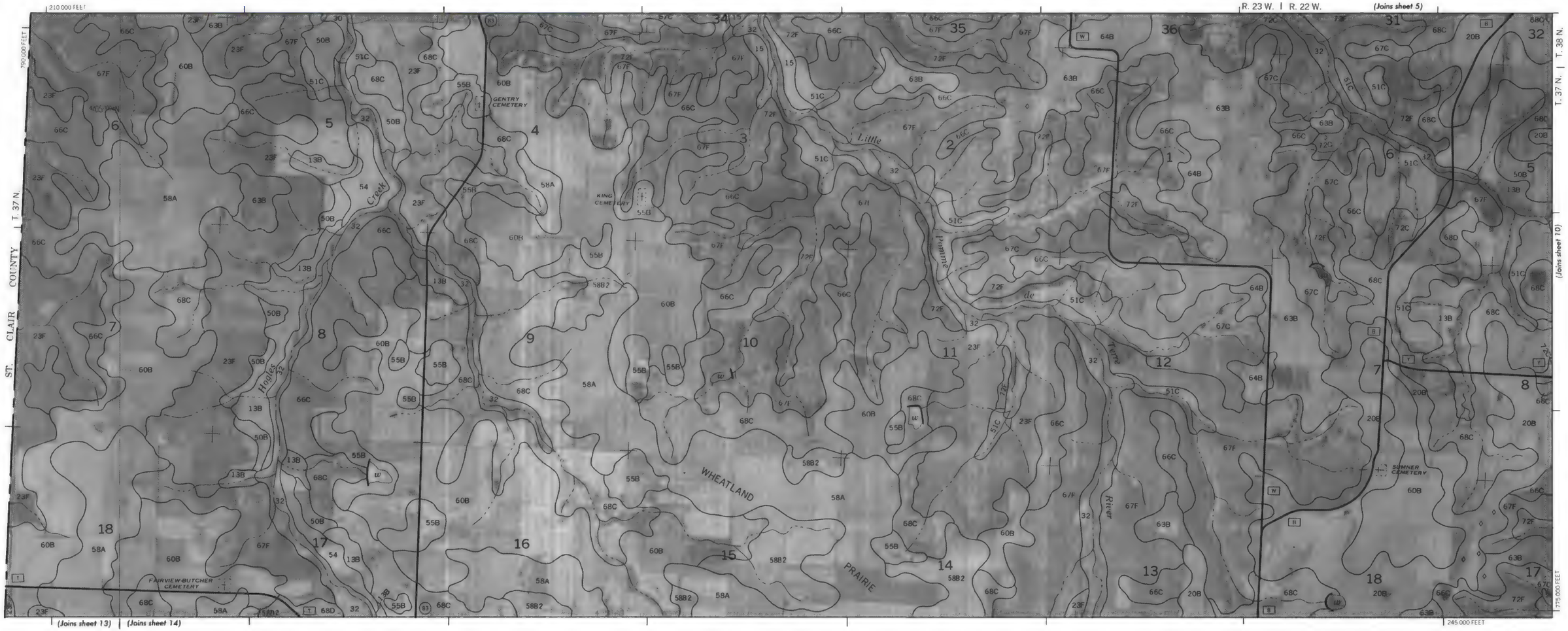
N
210 000 FEET
790 000 FEET
R. 23 W. | R. 22 W.
(Joins sheet 5)
T. 37 N. | T. 38 N.
ST. CLAIR COUNTY | T. 37 N.
(Joins sheet 10)
775 000 FEET
245 000 FEET
(Joins sheet 13) | (Joins sheet 14)
GENTRY CEMETERY
KING CEMETERY
FAIRVIEW-BUTCHER CEMETERY
SUMNER CEMETERY
Little Prairie
Little de Terre
Hogles Creek
WHEATLAND PRAIRIE
Little Terre River
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1 0.5 0 1 2 KILOMETERS
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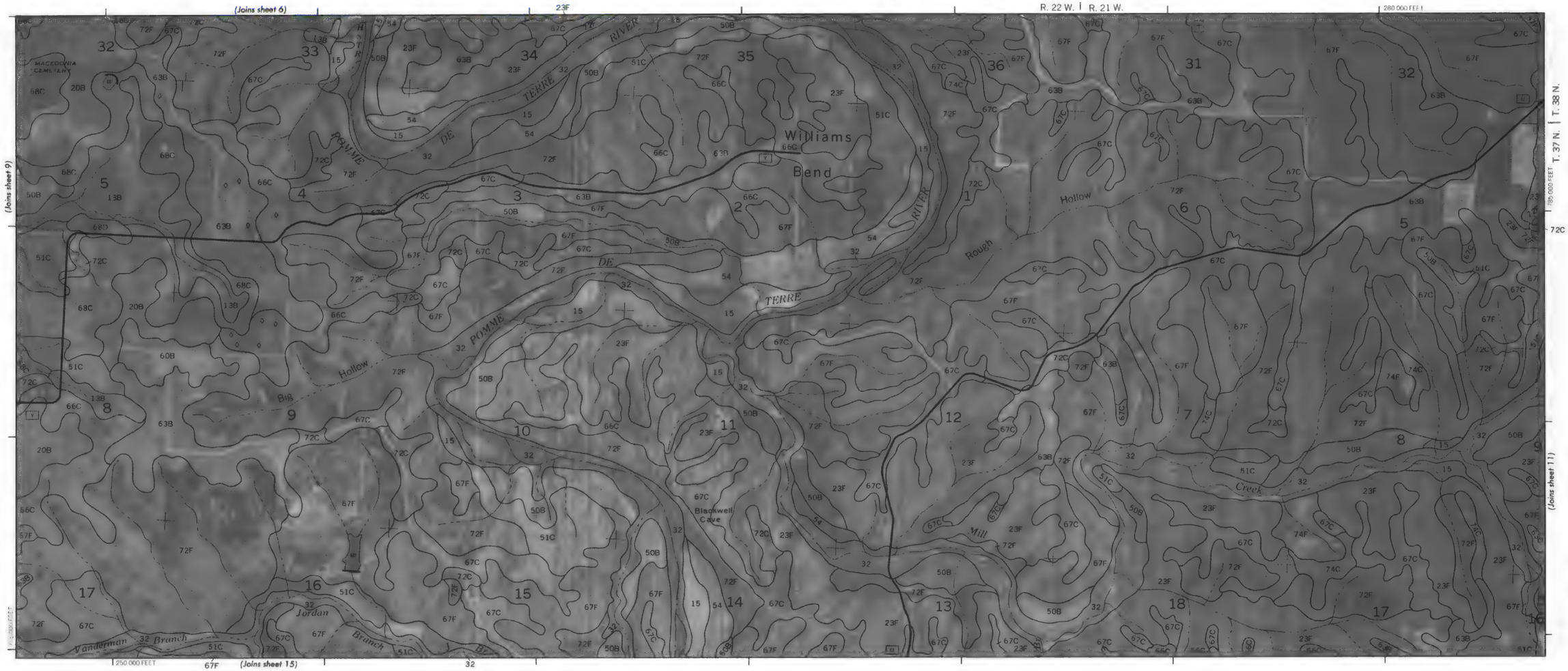

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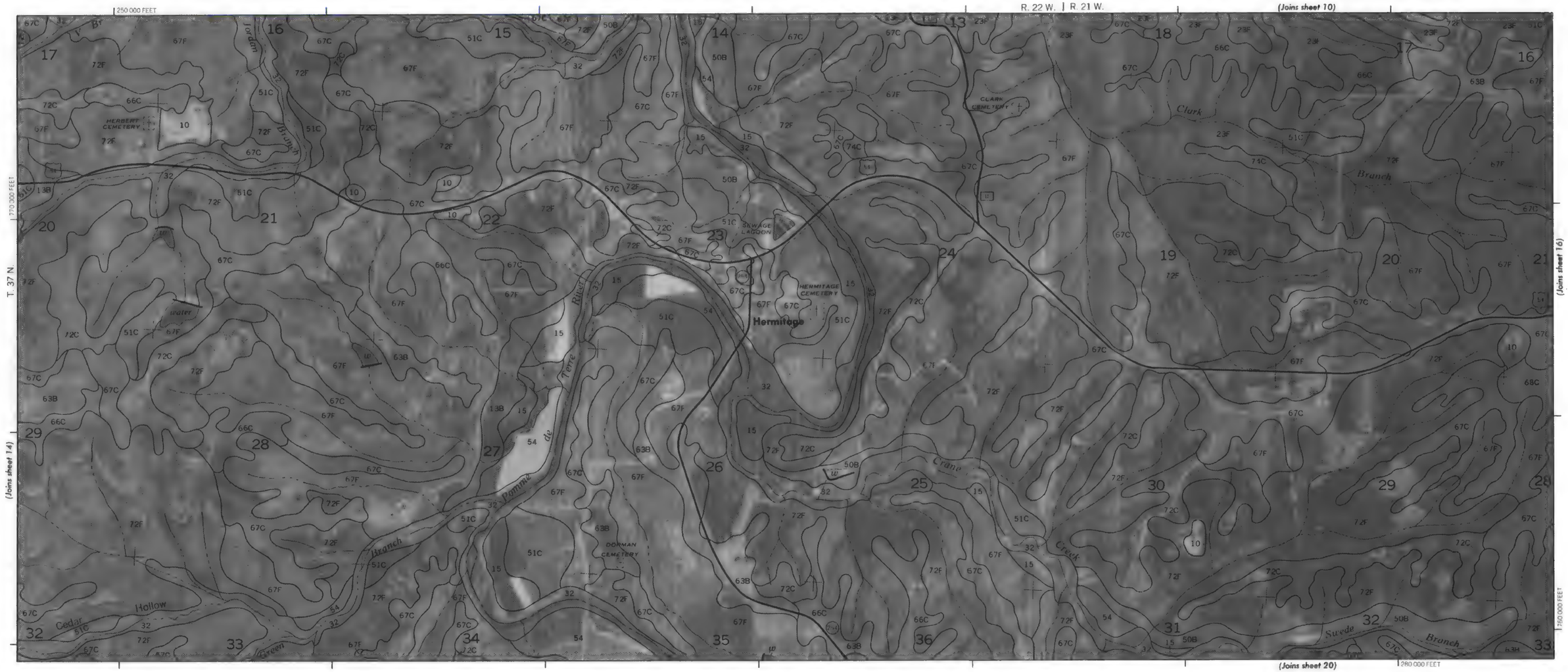

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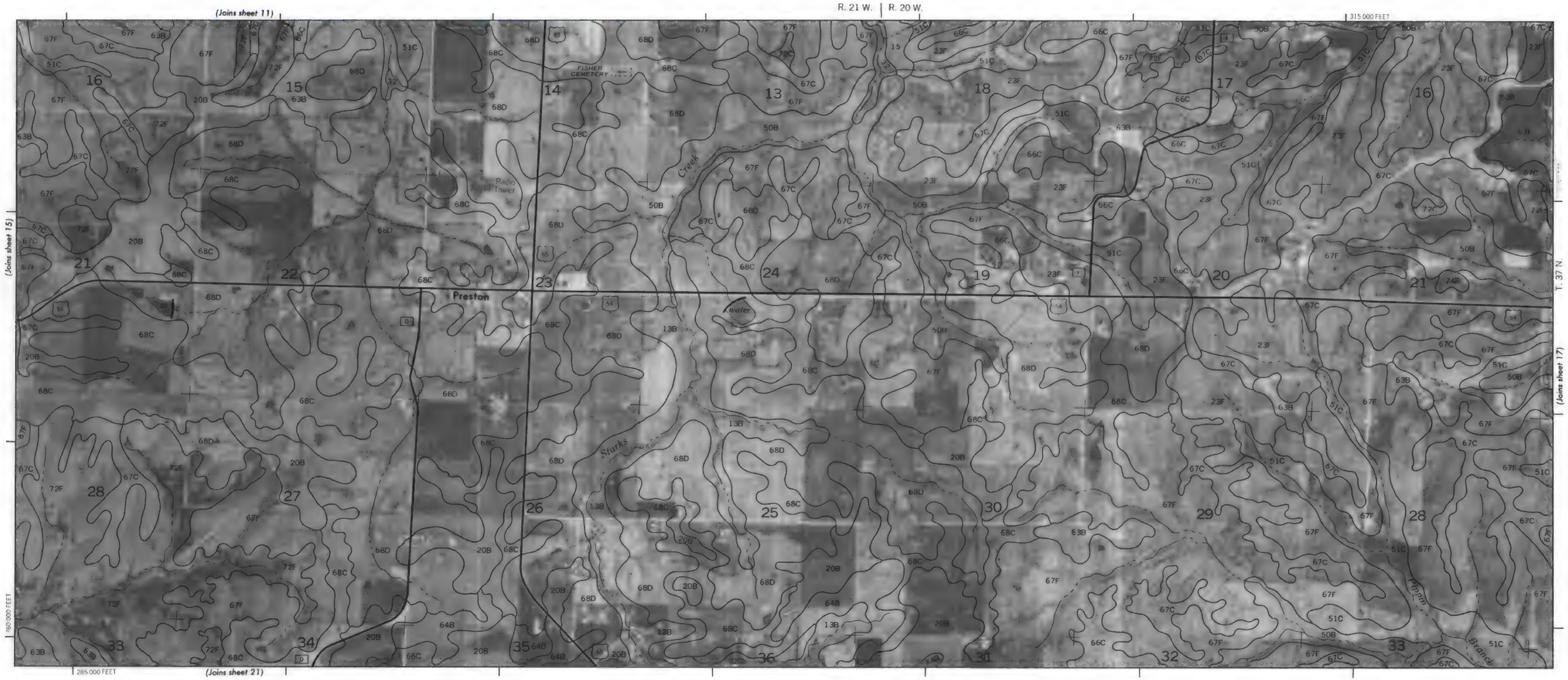

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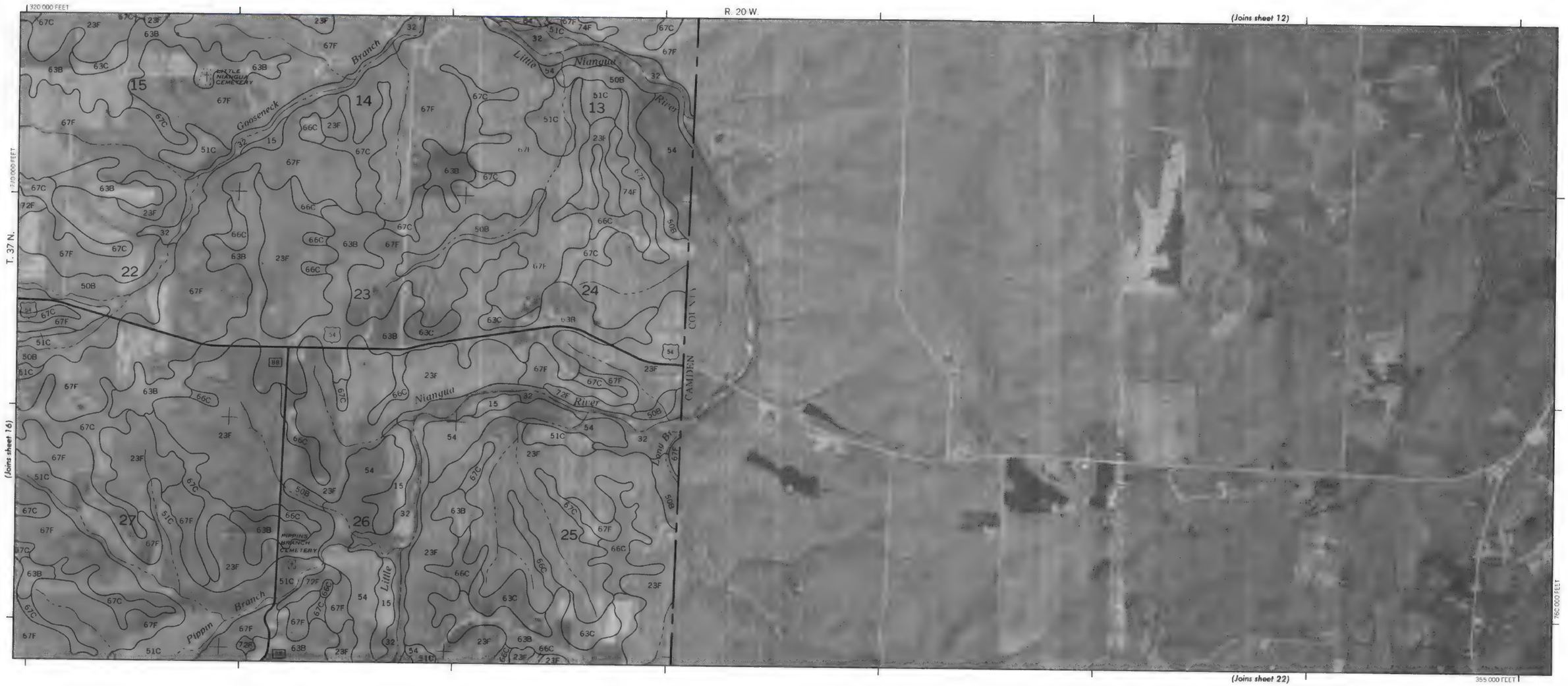

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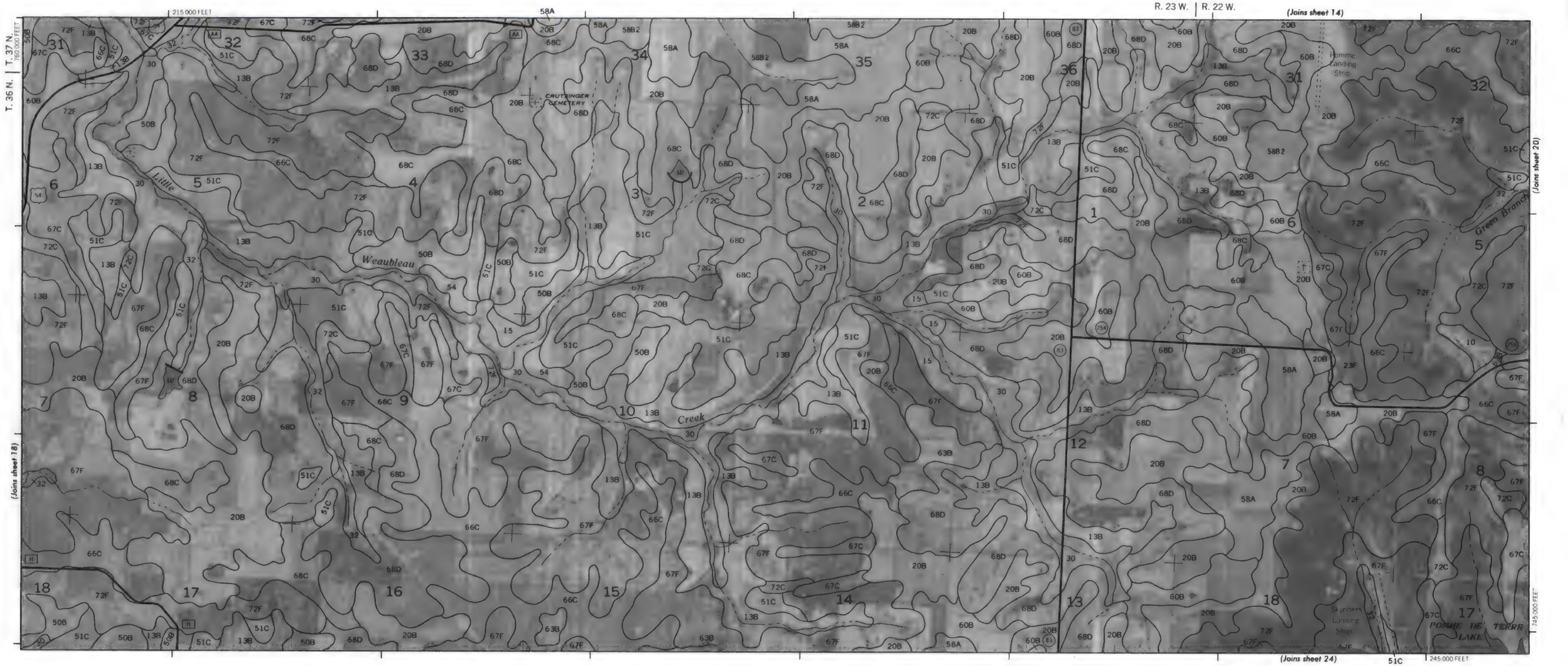

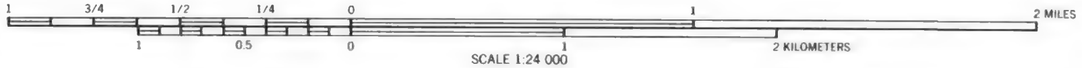

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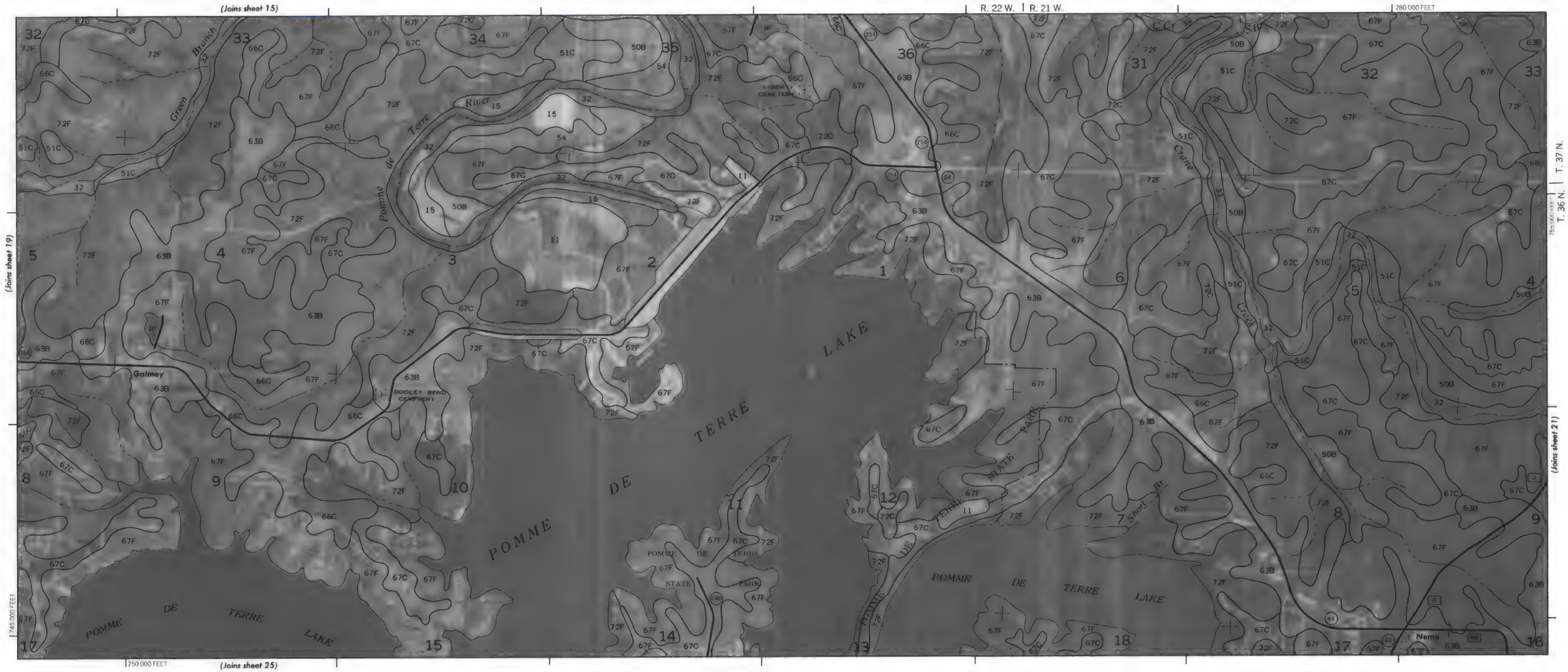

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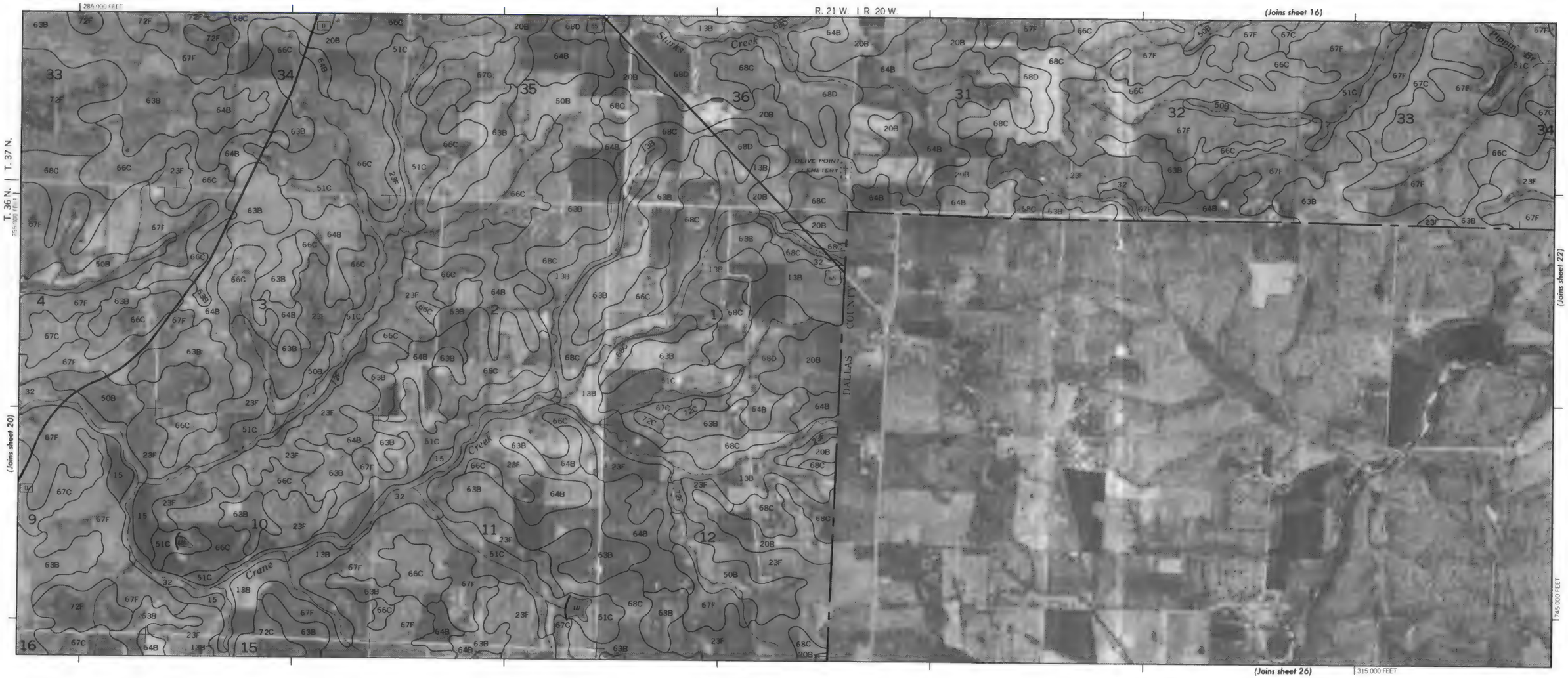

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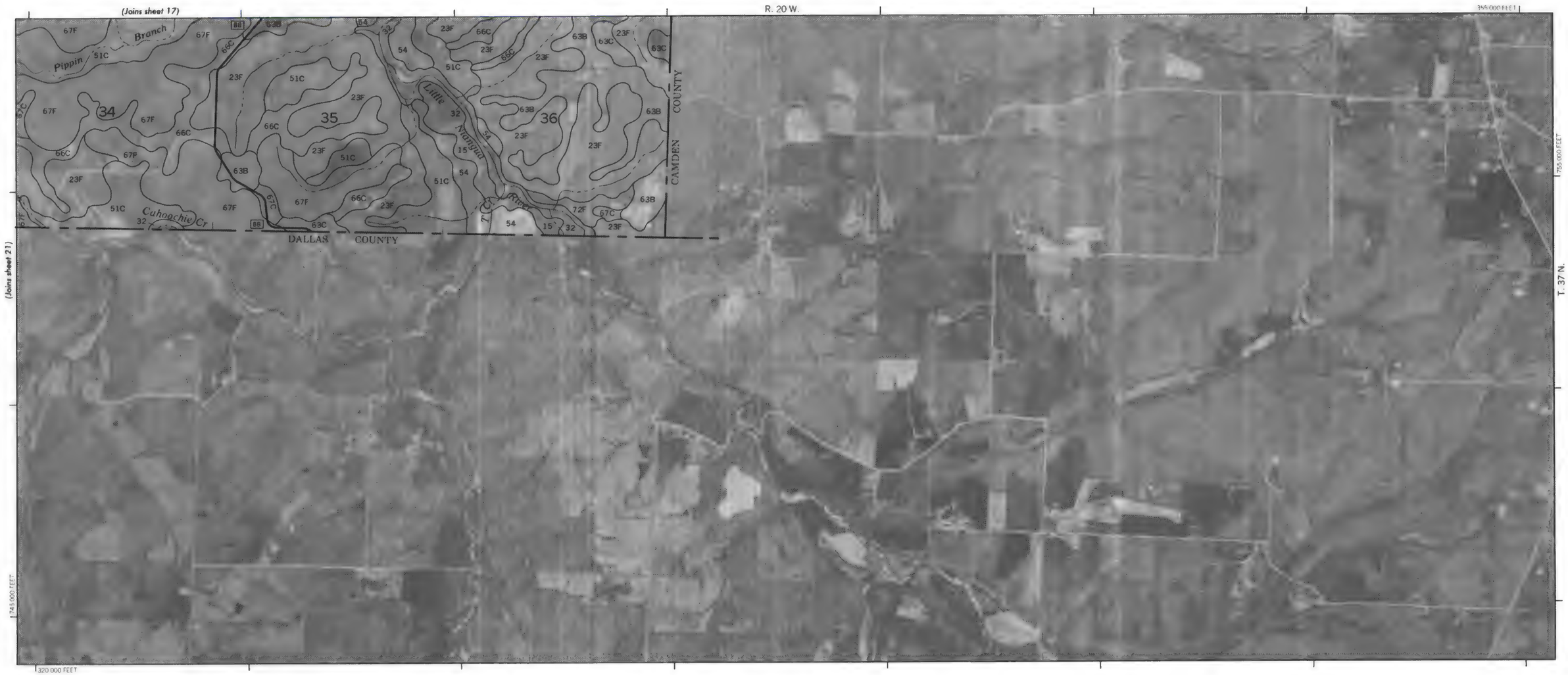

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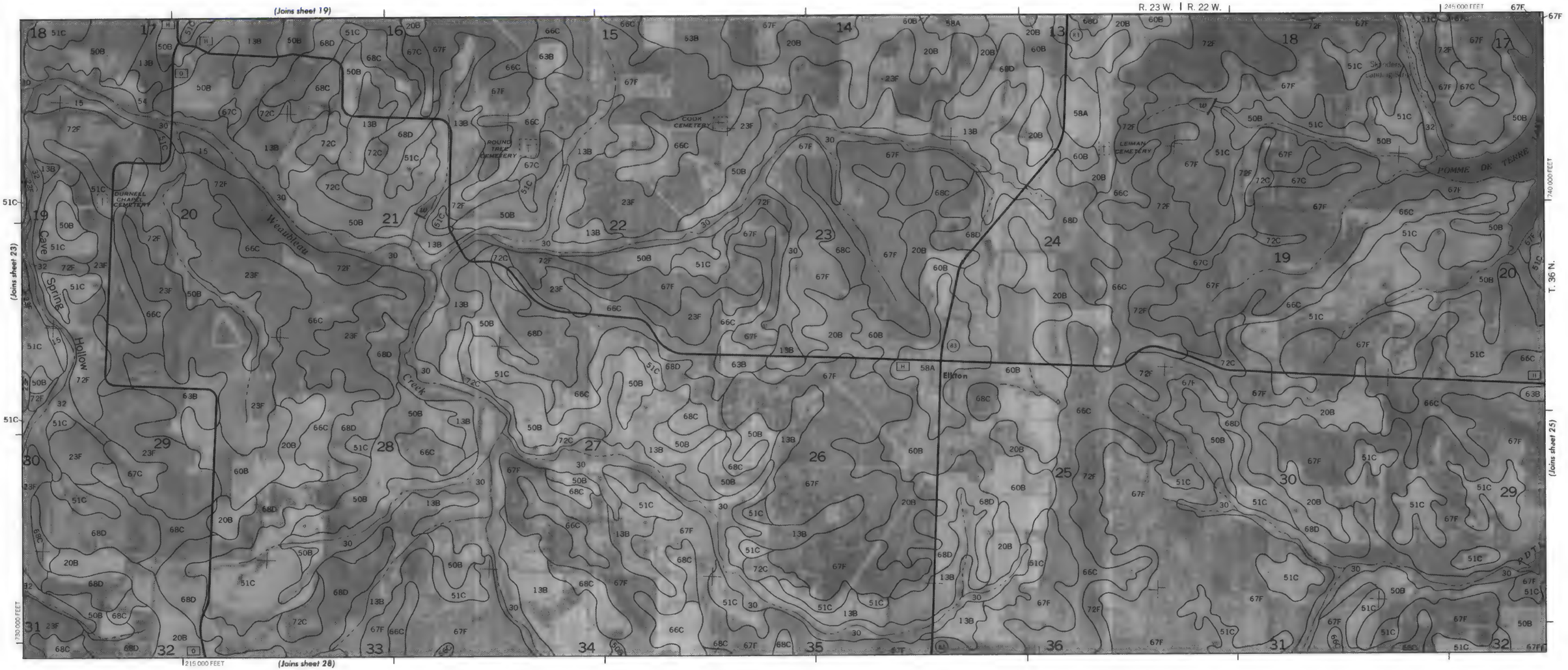

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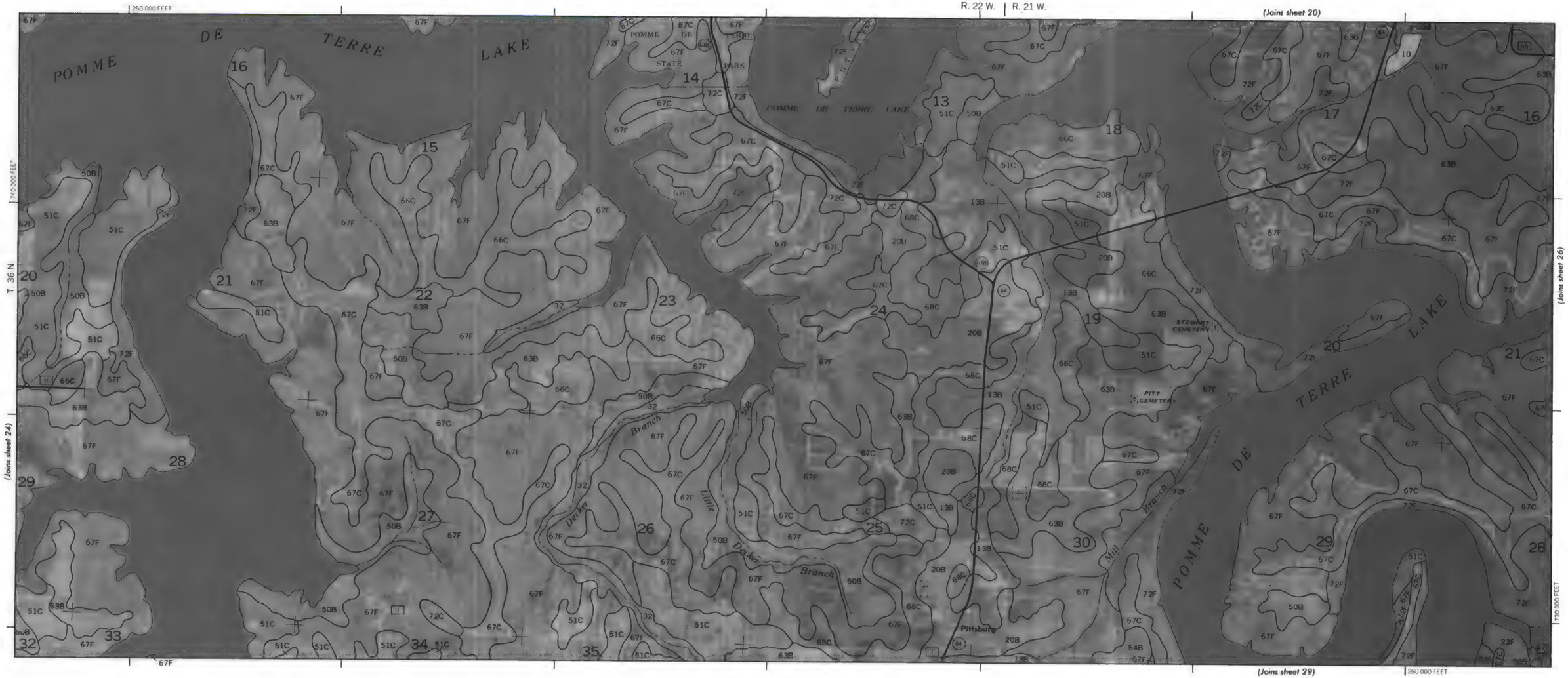

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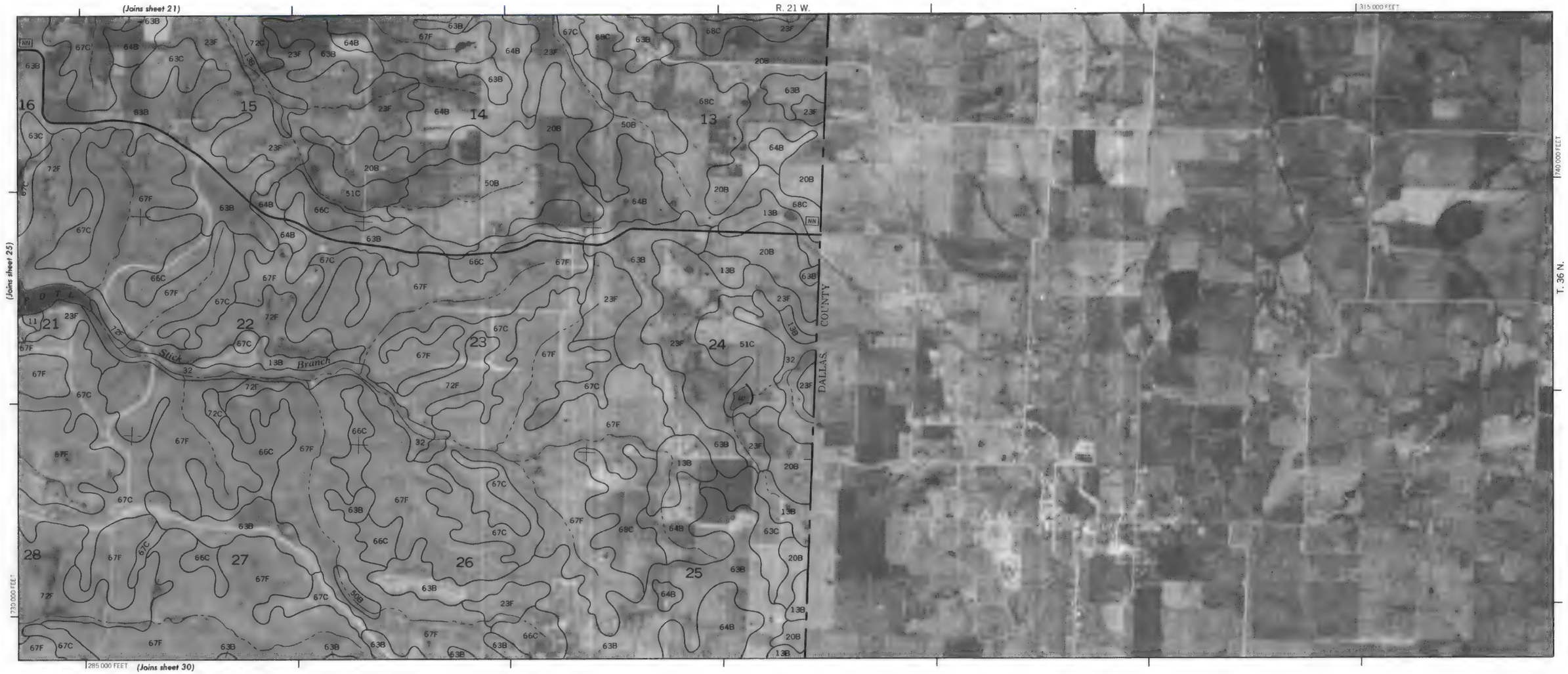

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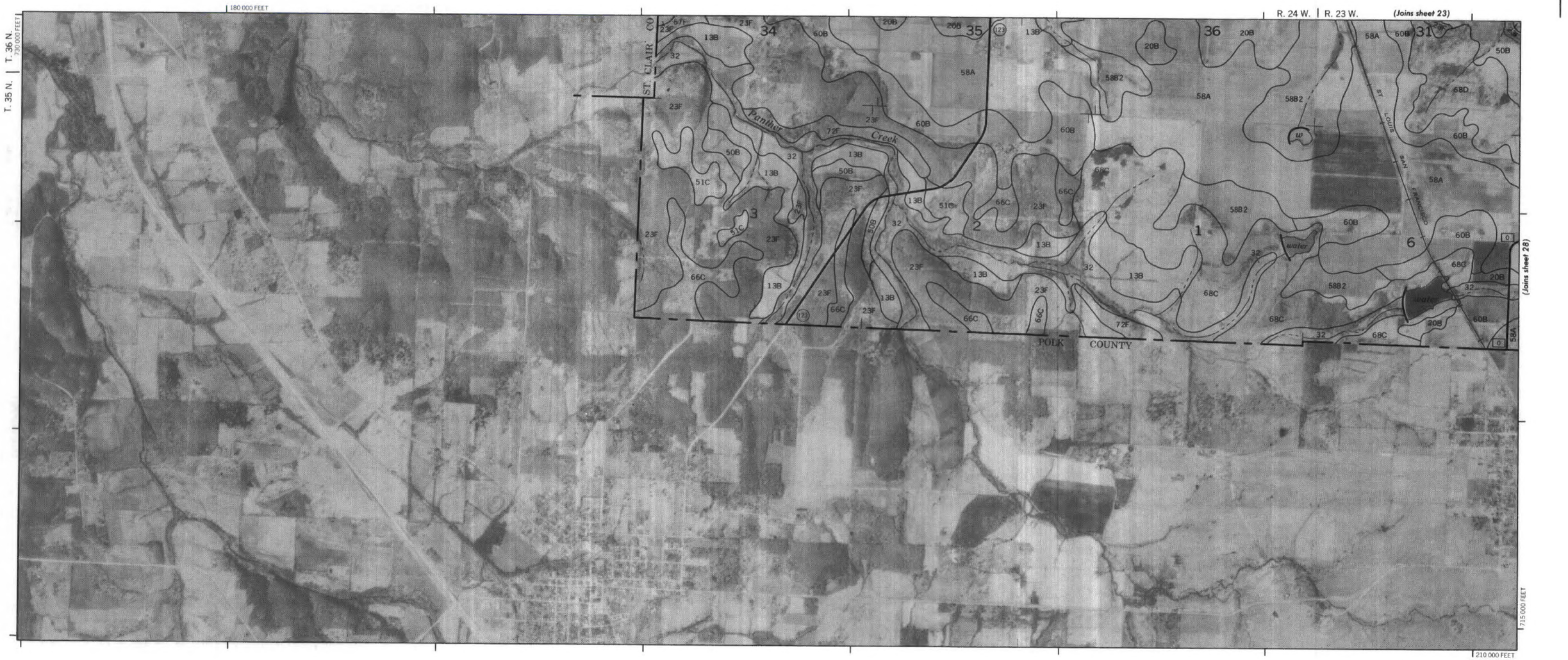

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2 MILES

2 KILOMETERS

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